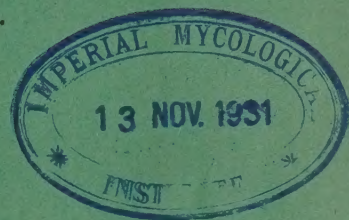


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UGANDA PROTECTORATE.



ANNUAL REPORT

OF THE

DEPARTMENT OF AGRICULTURE

FOR THE

YEAR ENDED 31ST DECEMBER, 1930.

(PART II).

PRICE: SHS. 5.

Published by Command of His Excellency the Governor.



ENTEBBE:

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DEPARTMENT OF AGRICULTURE.

ANNUAL REPORT

FOR THE YEAR ENDED 31ST DECEMBER, 1930.

(PART II).

REPORTS ON SCIENTIFIC WORK AND RESULTS OF EXPERIMENTS.

1. As mentioned in Part I of this Report, it has been considered desirable, on account of the extension of experimental work in the Department, to publish the Report in two parts:—

PART I.—ADMINISTRATIVE.

PART II.—REPORTS ON SCIENTIFIC WORK AND RESULTS OF EXPERIMENTS.

In this Part, wherever possible, full details of the experiments conducted have been given, as it is felt that without these details, much of the value of the experiments would be lost to workers in other countries engaged on similar lines of investigation.

2. In view of the importance to the Protectorate of the cotton crop, the reports of the Cotton Botanist and the Mycologist and the reports of experiments carried out at Serere and Bukalasa are of importance as indicating lines of work being undertaken with a view to

(a) improving the general quality of the lint;

(b) increasing the yield per acre;

(c) endeavouring to elucidate the fundamental causes of disease of the plant, more particularly blackarm (*Bacterium malvacearum*) which, during the last few years, has assumed a position of prime importance as the main factor affecting the yield of the crop over a large part of the cotton producing areas.

3. In this connection care must be exercised in accepting the conclusion arrived at by the Cotton Botanist, Mycologist and the officers in charge of Serere and Bukalasa experiment stations to the effect that after a severe outbreak of blackarm in any one area no advantage is to be gained by the introduction of clean (*sic*) seed into the area, provided that a good stand is obtained and provided that the disease is not epidemic in the year in question.

4. It will be noted that in the experiments at Serere and Bukalasa, even with a heavy seed rate at the latter station, the percentage stand obtained was significantly greater in the case of clean seed, whilst from the counts of angular leaf spot made at Serere it would appear that a lower percentage infection was obtained with this seed.

In both these experiments, it is conceivable that the whole of the crop became involved by plant to plant infection, and it would therefore appear that no great importance can be attached to the final yields obtained.

5. The experiments do, however, tend to show, as is to be expected, that a much more viable seed can be obtained from clean areas, resulting in a bigger stand. From the experimental point of view it is unfortunate that in the 1930-31 season blackarm was practically non-existent. Experiments have been laid down this year to test the effect of treating the seed prior to sowing with various fungicides, and if these experiments are successful they may indicate that the introduction of healthy, viable seed, treated so as to destroy any of the bacteria carried on the seed coat, would be the best policy to adopt regarding seed distribution in areas following a severe outbreak of the blackarm form of the disease.

G. F. CLAY,

Acting Director of Agriculture.

ANNUAL REPORT ON SERERE EXPERIMENT STATION AND EXPERIMENTAL WORK IN THE EASTERN PROVINCE, 1930—31.

The work of the year can be conveniently described under four heads:—

SECTION 1.—SERERE EXPERIMENT STATION.

SECTION 2.—NGETTA FARM AND SUBSIDIARY EXPERIMENT FARMS.

SECTION 3.—DISTRICT EXPERIMENTAL WORK.

SECTION 4.—BUGUSEGE COFFEE PLANTATION.

The work done on different crops is summarised at the end of this Report.

SECTION 1.

SERERE EXPERIMENT STATION.

The new farm, which was stumped and ploughed during 1929, came into use in the year under review and thus enabled the work to be organised as follows:—

A. Experiment Farm.—Provision is made for large plot experiments with cotton, groundnuts, sim-sim and maize on three 10-acre blocks under a rotation including two green manures in three years. There are also three one-acre plots for breeding and progeny row work with the same crops; and two permanent experiments—the Rotation Experiment and the Erosion Experiment.

B. Seed Farm.—This serves for increasing the bulk of a new strain of cotton destined for general cultivation *via* the Mulondo segregated area; for the provision of sound seed mass selected from other economic crops; maintenance of seed stocks of minor crops; and determination of the costs of production.

C. Isolation Plots.—There are three pairs of one-quarter-acre isolated plots and two 2-acre isolated plots for running up new strains from the breeding plots. One plot of each pair is used for cotton in alternate years. In the following year it is available for other crops, and is green manured.

BUILDINGS.

The housing accommodation was increased by two new houses built during the year. A lecture room and quarters have been provided for the native schoolmasters' agricultural course.

METEOROLOGICAL CONDITIONS.

As detailed figures of meteorological observations are now published separately the complete figures are not given here. The total rainfall of 56·26 inches was about two inches above the average but its distribution showed some variation from the normal. The average rainfall for June and July, is between four and five inches for each month, and there is always a short dry spell in one of them. In the year under discussion, however, there was a very severe drought in July the rainfall being the lowest recorded for that month. The monthly rainfall after this was above the average until November, when another untimely dry period set in. Heavy rain fell in early December, which is unusual. The latter half of the month was dry and the normal dry season followed.

A. Experimental Work.

COTTON SOWING DATE AND SPACING TRIAL.

Objects.—This experiment was designed to test the standard practice of planting cotton in rows 4 ft. wide with plants $1\frac{1}{2}$ ft. apart in the rows, against a spacing of 3 ft. by 1 ft., and to find out the optimum sowing date.

Spacing experiments and sowing-date experiments had been conducted by the Cotton Botanist since 1926. The last of his experiments, during the 1929–1930 season, was a combined sowing date and spacing trial, and the experiment now under description was a combined one.

Lay-out.—There were seven sowing dates at fortnightly intervals from May 20th to August 7th (the first interval was only nine days owing to the land not being ready in time), and the two spacings 4 ft. by $1\frac{1}{2}$ ft. and 3 ft. by 1 ft. were sown at each date. The randomised block method was used and the fourteen treatments were each planted in ten blocks. For each plot at 4 ft. by $1\frac{1}{2}$ ft., eight rows were planted, each row containing 26 plants. For each plot at 3 ft. by 1 ft. ten rows were planted, each row containing 39 plants. Before the first pick the outside rows of each plot were broken down. They were allowed to grow but cotton was only picked from six rows of 4 ft. by $1\frac{1}{2}$ ft. plots and eight rows 3 ft. by 1 ft. plots. Thus the size of plot used was 24 ft. by 39 ft., which is equivalent to rather more than $\frac{1}{46}$ th of an acre. In order to ensure a high stand of plants, ten seeds per hole were planted. The plants were thinned to one per hole. No re-sowing was done.

In September and October a great deal of angular leaf spot and some blackarm were to be seen, but the plants afterwards grew strongly and produced a heavy crop.

Results.—The yields are summarised below:—

TABLE I.

MEAN YIELD OF SEED COTTON IN LBS.

Date.		4 ft. by $1\frac{1}{2}$ ft.		3 ft. by 1 ft.		Mean.
May 20	...	18·4	...	16·2	...	17·3
May 29	...	17·8	...	17·9	...	17·8
June 12	...	17·1	...	16·7	...	16·9
June 26	...	14·1	...	16·0	...	15·1
July 10	...	9·9	...	9·7	...	9·8
July 24	...	10·1	...	9·6	...	9·8
August 8	...	5·7	...	5·9	...	5·8
MEAN	...	13·3	...	13·1		

The experiment is significant when $P=0\cdot01$. The Standard Error of the difference is 1·62.

Conclusions.—In this experiment all sowing dates gave significantly higher yields than that of August 8th. All plantings up to and including June 26th gave a significant increase over all later dates. While there is no significance among the first four dates there is a decline in yield with every advance in date from May 29th.

As regards spacing, although in the earliest planting the 3 ft. by 1 ft. spacing gave a lower yield than 4 ft. by $1\frac{1}{2}$ ft., this was not significant. All the other differences are small and in this experiment the two spacings were equally good.

Previous Work.—As mentioned above, similar experiments have been conducted in previous years by Mr. G. W. Nye, Cotton Botanist, and details can be found in the Annual Reports of the Department of Agriculture and in "Reports Received from Experiment Stations" published by the Empire Cotton Growing Corporation.

Fig. 1 summarises graphically the results of sowing date experiments from June, 1926—1930. In the experiment described above the results repeat the experience of previous years in that there is a decline in yield with advancing dates. The year 1929 was exceptional in that the May and June sowings yielded less than the July plots, but this and the low yield were due to blackarm. This was very exceptional and it is considered as conclusive that the optimum period for cotton planting is from mid-May to the end of June.

As regards spacing, the results of previous work have shown over a period of years a balance in favour of closer spacing and in the 1929—1930 trial 3 ft. by 1 ft. spacing was significantly better than 4 ft. by 1½ ft. In the present experiment, when yields were rather higher than usual, there is practically no difference between the two spacings.

It is to be noted that spacing experiments have been conducted using a high stand. In order to get a comparison between close and wide spacing both with an approach to a theoretical stand, and with the low stand obtained by native methods of planting, this experiment will be modified in the coming season. The sowing dates will be reduced to two, one during the optimum time and one later, while the spacings 4 ft. by 1½ ft. and 3 ft. by 1 ft. will be planted using three, six, nine, and twelve seeds per hole. As none of these will be replanted the three-seed treatment will correspond to what the native does, and if one of the higher seed rates proves superior it may be that he would be better advised to plant more seeds to the hole and not bother about replanting.

BLACKARM EXPERIMENT.

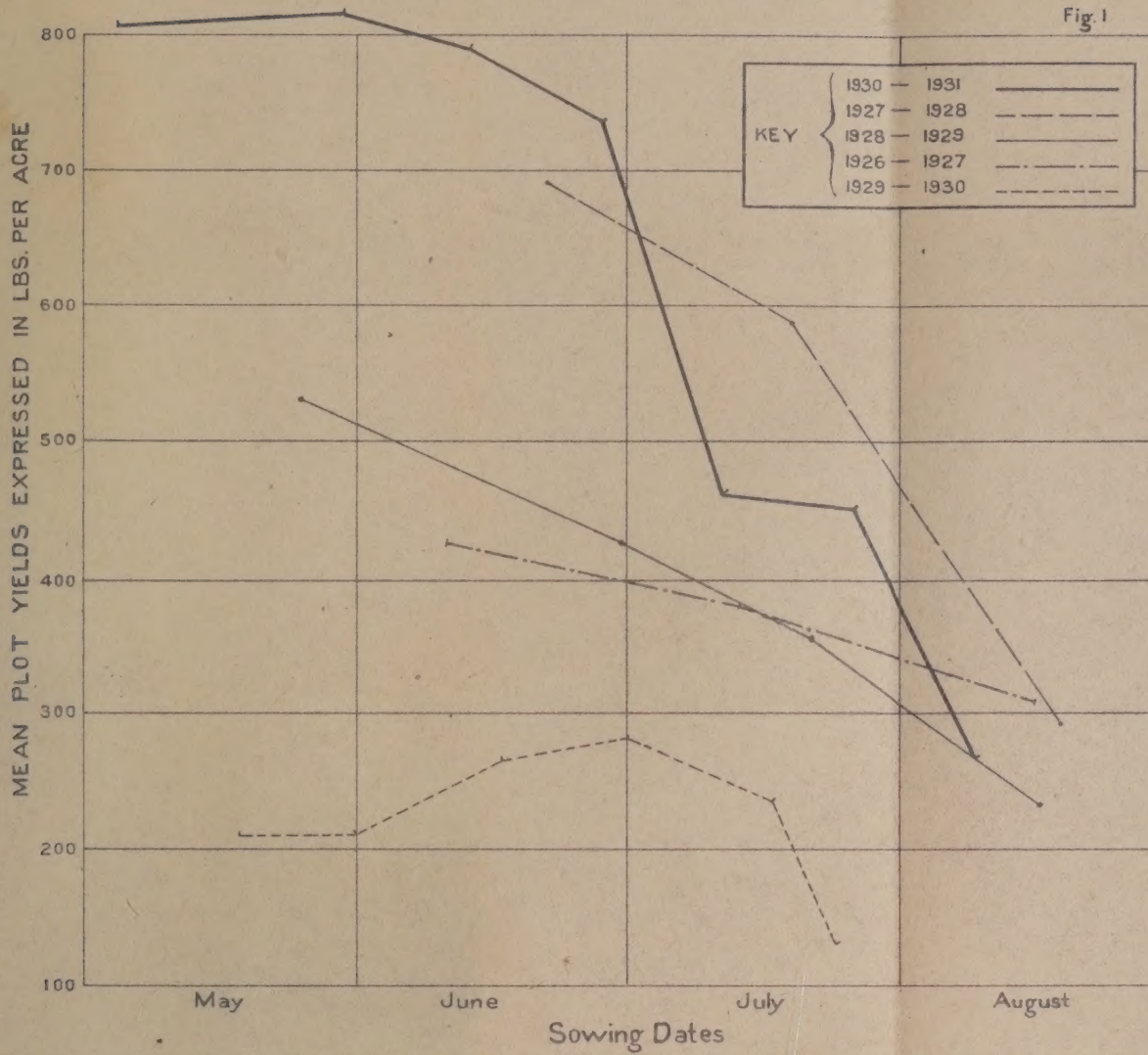
Object.—The 1929-30 crop over large areas of the Eastern Province failed owing to blackarm. Teso district, in which Serere is situated, was the worst affected, the average yield for the district being about 60 lbs. per acre, while the yield at Serere was much below the Serere average. This is well shown in Fig. 1. Further, the seed showed a serious decline in weight, some samples of cotton giving a seed weight of 40% below normal. Whether this was due to blackarm, or adverse weather conditions, or a combination of both, it appeared possible that this seed would either produce a crop heavily infected with blackarm or one which would not have the stamina to stand up against the attacks of diseases and pests or unfavourable weather. Such a failure over a large area would have been disastrous, and it was decided to get seed from the southern part of Busoga, where the cotton was comparatively free from blackarm, the yield fairly good, and the seed of normal weight. This was distributed at considerable expense in place of the seed from infected cotton. At the same time it seemed desirable to test the incidence of blackarm on cotton grown from seed of heavily infected cotton and to observe the yield, thus to get information as to whether, after any future occurrence of a crop failure from blackarm, anything is to be gained by the introduction of fresh seed.

The experiment was conducted with seed from Katakwe, which is 50 miles from Serere in a very heavily infected area, from Mukura, which is 12 miles from Serere in a less affected area, and from Buganda, where the cotton was slightly affected with angular leaf spot but not with blackarm on the stems or any other part of the plant. Before proceeding further it should be borne in mind that, as is inevitable in an experiment of this kind, an uncontrolled factor was brought in due to the different climatic conditions under which the three cottons had previously been grown. Further, that while the Katakwe and Mukura cottons came from the same original stock, the origin of the Buganda cotton is obscure.

Lay-out.—

Treatments ...	...	...	...	Buganda seed	=	B
				Katakwe seed	=	K
				Mukura seed	=	M
Number of Plots	...	...	...	...		21
Size of Plot picked	...	...	...			15 ft. by 144 ft.
Spacing	...	...	...			3 ft. by 2 ft.

COTTON SOWING DATE EXPERIMENTS 1926-1930



BLACKARM EXPERIMENT. SERERE 1930

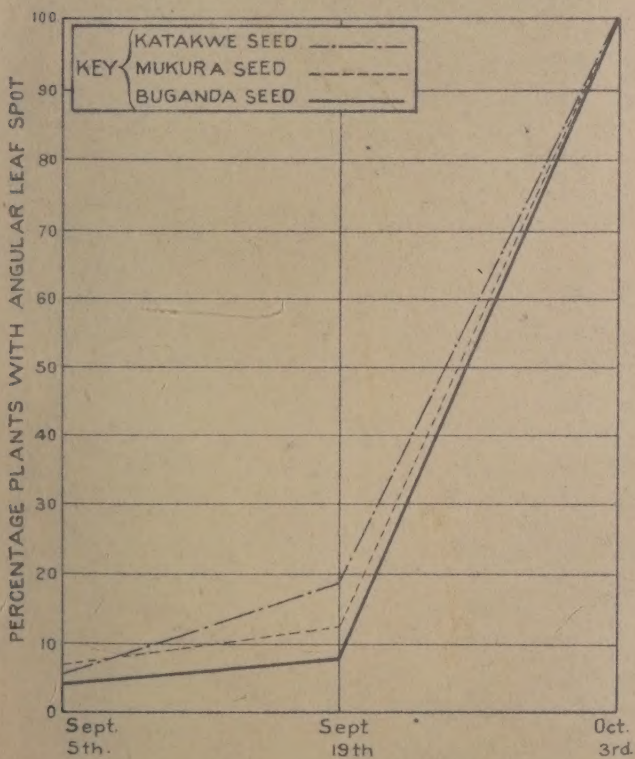


Fig. 2

MAIZE SPACING TRIAL WITH ONE AND TWO PLANTS PER HOLE

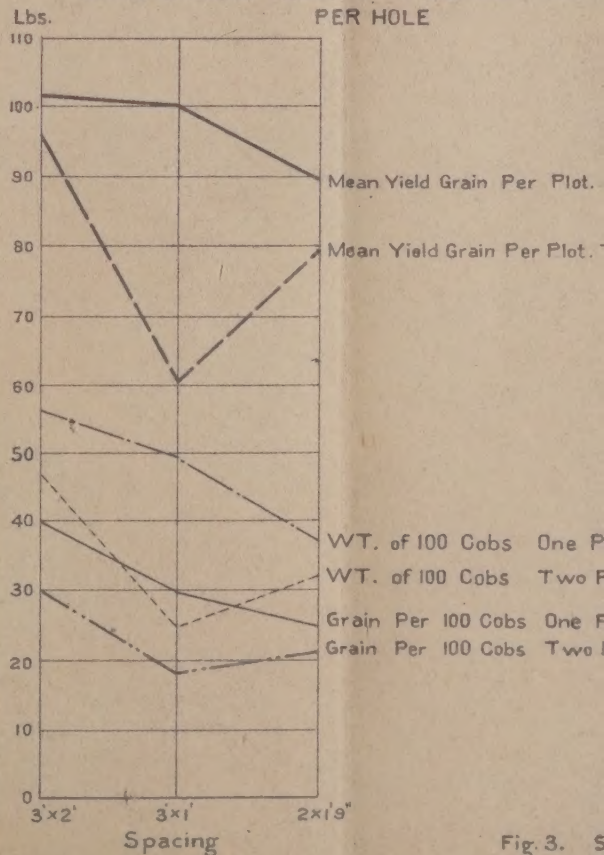


Fig. 3. S

The experiment was laid down in 21 strips of six rows each, the first and every odd-numbered plot being Buganda seed, and the position of the Mukura and Katakwe seed plots on either side of each inside plot of Buganda seed being determined in each case by the spin of a coin. The plots were arranged thus:—

B K B M B M B K B K B M B M B K B M B K B.

The plots were planted on July 5th and the blanks filled on July 22nd. There was an outside row at each end of the experiment. Weather conditions following planting provided a good test of the vigour of the seed. July was the driest on record at this station, only 1.97 inches of rain falling during the month.

RESULTS.

Counts for Angular Leaf Spot.—Counts were made on September 5th and September 19th and again on October 3rd with the following results:—

TABLE II.

Plots planted with seed from				Mean percentage per plot of plants attacked by Angular Leaf Spot.		Percentage of Theoretical stand.	Relative stand.
				Sept. 5th.	Sept. 19th.		
Buganda	...	...	...	4.1	7.6	58.5	100
Mukura	...	...	...	6.7	12.4	51.7	88
Katakwe	...	...	...	5.9	18.6	32.7	55

The results of the count on September 5th showed no significant differences between the three treatments, but on September 19th the Buganda cotton has significantly less leaf spot than Katakwe. The difference between Buganda and Mukura was approaching significance, but on October 3rd practically 100% of the plants had angular leaf spot in all three seed treatments and no further counts were made. See Fig. II.

After this date blackarm lesions were to be seen on the leaf petioles and stems of the plants in all three treatments, but the plants grew strongly and produced a normal crop of cotton.

Seed Weight.—Reference is made above to the depression in seed weight among the general crop from which the Katakwe and Mukura seed was derived, and the following figures are of interest in showing the recovery from this state:—

TABLE III.

					Weight of 100 Seeds in Grams.		
					1930.	1931.	
Buganda	...	...	...	...	9.34	...	10.00
Mukura	...	...	...	...	7.56	..	10.18
Katakwe	...	...	...	...	6.93	...	10.24

Yield.—At picking time the first row of each plot was cut down, leaving five rows of each treatment to be picked.

TABLE IV.

					Mean Yields of Seed Cotton in Lbs.		
Buganda	...	...	...	...	...	35.4	
Mukura	...	...	...	...	...	31.8	
Katakwe	...	...	...	...	...	30.0	

The yield results were worked out in two different ways—(1) by Fisher's method in which plots 2, 3, 4 and 6, 7, 8, etc., were treated as if they were randomised blocks; (2) on the principle of Beavens half-drill strip method which provides a comparison for the Katakwe and Mukura treatments with the Buganda treatment on either side. With the randomised block method the analysis of variance, with a Standard Error of 1.3, shows that the yield of the Buganda cotton is significantly greater than both Katakwe and Mukura. There is no significance between the yields of Katakwe and Mukura cotton.

In the second method of working there is a Standard Error of 1.06 for the difference between B and K, and S.E. 0.99 for the difference between B and M. Both these are significantly in favour of the Buganda cotton. The S.E. of the difference between M and K is 1.51 and this is not significant.

Yield per Acre.—The lowest yield among the three treatments gave a mean of 30 lbs. per plot, which is 600 lbs. when expressed per acre. The sowing date trial on the same field gave the following yields per acre—June 26th sowing 735 lbs. per acre, and July 10th sowing 460 lbs. per acre.

Conclusions.—

(a) From the preceding paragraph it can be seen that even the seed from the cotton which was worst affected with blackarm produced a good yield of cotton, and from the calculation it cannot be said that the Mukura seed, from cotton less diseased, gave a real increase in yield.

(b) It should be pointed out that the general crop in the Eastern Province was similar to the crop in this experiment in that angular leaf spot was very prevalent and blackarm lesions appeared, but did negligible damage.

In the experiment the diseased seed treatments showed a quicker development of angular leaf spot, but from the seed weight of the resulting cotton the opinion is put forward that the angular leaf spot and blackarm did no more damage in one treatment than in another.

(c) It is not possible definitely to say to what is due the superior yield of the Buganda cotton owing to the uncontrolled factors of variety and previous climatic conditions, but the difference in spacing (as shewn by the stand count) would be sufficient to account for the difference in yield.

(d) The lower percentage stand and consequent wider spacing in the Mukura and Katakwe cottons must be in some way connected with the initial low seed weight.

GROUNDNUT SPACING AND CULTURAL TRIAL.

Objects.—This experiment was designed to demonstrate the best spacing for the erect or bunch type of groundnut when grown in lines, or broadcast, or in ridges, and to discover whether anything is to be gained by line sowing or ridging as opposed to the native method of broadcasting.

Lay-out.—Four spacings were tried combined with the three cultural treatments and there were twelve combined treatments, thus;—

<i>Spacing.</i>		<i>Size of Plot.</i>	
1 ft. by 1 ft.	} In lines, on ridges, and broadcast	14 ft. by 105 ft.	
1 ft. 6 ins. by 1 ft. 6 ins.		15 ft. by 105 ft.	
3 ft. by 1 ft.		18 ft. by 105 ft.	
2 ft. by 1 ft.		16 ft. by 105 ft.	

These were repeated five times in five randomised blocks. Between each sub-plot there was a path three feet wide. The dimensions of the sub-plots as given above included two outside rows and in the case of the broadcast plots, outside strips. At harvest these outside parts were discarded so as to leave in all cases a width of 12 ft. from which yields were taken.

One seed per hole was planted and one re-sowing of blanks was allowed in all but the broadcast plots. In the latter the same weight of seed was put in as corresponded to the weight planted in line plots of equivalent spacing, plus 25% to allow for non-germination.

The plots were sown on April 16th and harvested on August 4th.

TABLE V.

MEAN YIELD OF GROUNDNUT PLOTS IN LBS. UNSHELLED.

Spacing.	Cultural Treatment.			Mean of Spacings.
	Lines.	Ridges.	Broadcast.	
1 ft. by 1 ft. ...	44.0	43.6	42.0	43.2
2 ft. by 1 ft. ...	38.8	35.8	40.2	38.4
1 ft. 6 ins. by 1 ft. 6 ins. ...	36.4	33.4	32.4	34.1
3 ft. by 1 ft. ...	26.4	31.6	34.6	30.9
Mean of Cultural Treatments	36.4	36.1	37.3	36.6

The Standard Error of the comparisons is 5.16 and differences of 10.32 are significant.

Conclusions.—The following significant differences are apparent:—Spacings 1 ft. by 1 ft. is significantly better than 3 ft. by 1 ft. in lines and ridges. Spacing 2 ft. by 1 ft. is significantly better than 3 ft. by 1 ft. in lines.

There is a difference between the means of spacings amounting to 12.3 in favour of the 1 ft. by 1 ft. spacing over the 3 ft. by 1 ft. spacing, and it is noticeable that the order of yield is in the same order as the theoretical number of plants per acre given by the different spacings.

It seems fairly definite that 3 ft. by 1 ft. spacing is too wide and while the yields of the 1 ft. by 1 ft. plots are not great enough to allow of a definite superiority over 2 ft. by 1 ft. and 1 ft. 6 ins. by 1 ft. 6 ins. spacing being claimed, the indications are that the best results would be obtained by planting bunch groundnuts at 1 ft. by 1 ft.

In this experiment nothing has been gained as regards yield by planting in lines or in ridges. The broadcast plots yielded just as well.

MAIZE SPACING TRIAL FOR AUTUMN PLANTING.

Objects.—To determine the best spacing for maize sown in the “autumn” and to find out whether there is any advantage in leaving two plants per hole.

Lay-out.—The spacings adopted were:—

3 ft. by 2 ft.	with 1 plant and 2 plants per hole.
2 ft. by 1 ft. 9 ins.	“ “ “ “ “
3 ft. by 1 ft.	“ “ “ “ “

These six treatments were repeated ten times in randomised blocks. The sub-plots contained twelve rows in the 3 ft. spacing and fifteen rows in the 2 ft. spacing. At harvest the two outside rows in each plot were cut down, thus leaving 30 ft. by 78 ft. in each case.

Four seeds per hole were planted and the stand was subsequently thinned to two plants and one plant in the appropriate plots. The plots were sown on September 10th, and had very good growing conditions, the final yield being higher than is usual at this season. Harvesting began on January 5th, 1931.

Results.—The results of the experiment which are shown graphically in Fig. 3 are given in the following tables:—

TABLE VI.
MEAN YIELDS OF PLOTS IN LBS. OF GRAIN.

Spacing.	Number of Plants per Hole.	
	One Plant.	Two Plants.
3 ft. by 2 ft.	101.2	96.3
2 ft. by 1 ft. 9 ins.	88.7	79.5
3 ft. by 1 ft.	100.2	60.5
Mean	96.7	78.7

The experiment is significant by the Z test when $P=0.01$, and S.E. of comparisons is 2.94.

Two plants in the spacing 2 ft. by 1 ft. 9 ins. and 3 ft. by 1 ft. are significantly worse than one plant per hole. At spacing 3 ft. by 2 ft. the decrease is not significant.

The spacings of 3 ft. by 2 ft. and 3 ft. by 1 ft. with one plant per hole are equal, and both are significantly better than 2 ft. by 1 ft. 9 ins.

The spacing of 3 ft. by 2 ft. with two plants per hole are significant over both the other spacings with two plants, and 2 ft. by 1 ft. 9 ins. is better than 3 ft. by 1 ft. with two plants.

Discussion.—

(a) The 3 ft. by 1 ft. spacing with one plant has the same theoretical stand as the 3 ft. by 2 ft. with two plants, and yields are probably equal.

(b) The 3 ft. by 1 ft. two plants per hole probably suffers from overcrowding in the row and the superiority of the 2 ft. by 1 ft. 9 ins. treatment with two plants per hole might be explained by the fact that this does not occur to the same extent.

The cob weights and proportion of grain to cob are interesting in this connection :—

TABLE VII.

Spacing.			Weight of 100 cobs.		% Grain.	Weight of 100 cobs.		% Grain.
			One plant.			Two plants.		
3 ft. by 2 ft.	...	...	56	...	71.4	47	...	65.9
2 ft. by 1 ft. 9 ins.	...	...	37	...	67.6	32	...	65.6
3 ft. by 1 ft.	...	...	49	...	59.2	25	...	43.2

The 3 ft. by 1 ft. with two plants per hole produced very small cobs with a low percentage of grain.

(c) There would seem to be little reason why the 2 ft. by 1 ft. 9 ins. one plant treatment should be so inferior to the 3 ft. by 1 ft. one plant treatment as there is not a great deal of difference in the theoretical stand. A light effect is suggested.

(d) The percentage of grain to cob in this autumn maize compares unfavourably with that of maize planted in the early part of the year. An experiment carried out at Serere in 1929 gave 81% grain to cob and there was no variation among the spacings.

Conclusions.—Growing maize with two plants per hole depresses the yield except in the widest spacing. 3 ft. by 2 ft. or 3 ft. by 1 ft. spacing gives a higher yield than 2 ft. by 1 ft. 9 ins. spacing.

SUB-SOILING EXPERIMENT.

Object.—To test the effect of subsoiling on the yield of maize and cotton.

Lay-out—An area, Block 9 of the Seed Farm, was marked out so as to give ten strips 45 ft. wide. The first strip and alternate strips were ploughed in the ordinary way using a Howard plough. The second strip and alternate strips were ploughed with the same plough having a cultivator tine fixed to the back of the beam. This got down to a depth of over twelve inches without bringing up the subsoil to the surface.

Maize.—Maize was planted on March 6th, at 3 ft. by 2 ft. spacing, there being fifteen rows per plot and the whole experiment being surrounded by the main crop of maize. At harvest the size of the plots from which cobs were picked was 45 ft. by 50 ft. = 1/16th acre. Results are shown below :—

		<i>Lbs. Cobs.</i>
Mean yield of five plots, ordinary ploughing	...	= 155.2
Mean yield of five plots, subsoiled	..	= 136.6
Difference in favour of ordinary ploughing		= 18.6

The results are very significant, "t" being 6.02.

Cotton.—Following the maize crop, cotton was planted on August 9th, at a spacing of 4 ft. by 1½ ft. and yields were taken from areas of 1/29th acre on the same strips of subsoiled and ploughed land. Results were as follows :—

		<i>Lbs.</i>
Mean yield of cotton from five plots of ordinary ploughing	=	20.8
Mean yield of cotton from five plots subsoiled	...	= 21.1
Difference	...	= 0.3

After picking had been completed measurements of the length of the tap root from plots of each treatment were made. This was done with 33 plants each from Plots 3—8. Plots 1 and 2 were cut down owing to a misunderstanding by the headman.

Mean length of tap root, ordinary ploughing	...	==	<i>Inches.</i> 9.55
" " " " " subsoiled	...	==	10.09
Difference	...		0.54

The Standard Error of the difference is 0.46 so that this result is not significant.

Conclusions.—The experiment shows that subsoiling to a depth of 12 ins. has an adverse effect on the yield of maize. It was expected that the cotton would respond to the treatment by showing an increase in the length of tap root and an increase in yield, but this was not the case.

SIM-SIM SOWING DATE AND SEED RATE TRIAL.

Object.—To find the best date for sowing sim-sim and the best seed-rate.

Lay-out.—The sowing-dates and seed rates were:—

March 18th—at 2½ lbs. 5 lbs., 7½ lbs. and 10 lbs. per acre.
April 1st " " " "
April 15th " " " "
April 29th " " " "

These treatments were combined into sixteen treatments and laid out in nine randomised blocks. Each sub-plot was 135 ft. long by 12 ft. wide, the width being that of the seed barrow with which the plots were sown. Between each sub-plot was left a path of 3 ft.

Results.—An experiment of this nature conducted with a small seeded crop such as sim-sim is liable to be upset by a heavy fall of rain at sowing time. Thus on the night of April 29th after the last 16 plots had been sown nearly two inches of rain fell and a large proportion of the seed was washed out of the ground. If the sowing date had been fixed as April 30th, no doubt a good stand of plants would have resulted but as it happened the yields from the April 29th plots were so low that they were disregarded in the calculation though they are given outside the table shown below:—

TABLE VIII.

Sowing Date.				Seed Rate per Acre in Lbs.				Mean of Sowing Dates
				2½	5	7½	10	
March 18th	...	...	...	5.56	6.66	7.50	7.70	6.86
April 1st	...	...	...	6.26	5.55	8.66	10.05	7.63
April 15th	...	...	...	2.66	4.50	7.26	5.33	4.86
Mean of Seed Rates	...	...	...	4.81	5.46	7.81	7.71	6.45

The experiment satisfies the Z test when P = 0.01 so that it is very significant. Differences of 2.62 are significant.

The yields of the April 29th plots which were not included in the above means were 1.90, 2.22, 3.16, 2.83 lbs. for the respective seed rates.

In the analysis of variance the interaction of “Dates” is significant over random errors, but this is not the case with seed rates.

Conclusions.—No seed rate can definitely be said to be better than another except when combined with certain dates, thus:—

10 lbs. per acre is better than 2½ lbs. per acre on April 1st and April 15th.
10 " " " " " " 5 " " " on April 1st.
7½ " " " " " " 2½ " " " on April 15th.
7½ " " " " " " 5 " " " on April 1st and April 15th.

Sowing Date.—April 1st is a better sowing date than April 15th. Broadly speaking this experiment indicates that the earlier dates and the heavier seed rates give the higher yields and that with late sowings more seed should be sown.

A sowing date trial conducted in the previous season showed that the yield declined with every advance in date, the dates being April 5th, April 19th, May 3rd and May 17th.

The indications given by the two experiments are that the optimum sowing date is not later than the early part of April. It would seem advisable to arrange the next sowing date trial so as to include sowings from March 1st to April 15th.

PERMANENT ROTATION EXPERIMENT.

This experiment, which is down for five years, is designed to test the rotation of crops proposed for the Eastern Province.

The rotation is given below with the three modifications being tested:—

A.	B.	C.	D.
Cotton	Cotton	Cotton	Cotton
Bulo	Groundnuts	Green manure.	Sim-sim
Cotton	Cotton	Cotton	Cotton
Groundnuts	Bulo	Sim-sim	Groundnuts
Sim-sim	Green manure	Groundnuts	Bulo
Green manure	Sim-sim	Bulo	Green manure.

This rotation is meant for a native cultivating three plots of one acre, so as to enable him to produce saleable export crops. Bulo (*Eleusine coracana*) is interchangeable with maize where it is an economic crop. At the time of writing maize is not an economic crop over the greater part of the Eastern Province so that bulo is being grown in the experiment. It is the staple food over a large area. The cotton, groundnuts, and sim-sim are meant for sale. This rotation on three acres gives one acre of early cotton, one acre of late cotton, one acre of groundnuts and one acre of sim-sim during the year. That is to say, it should do so under the right conditions. The results so far obtained at Serere, which has a climate similar to most of the central and northern parts of the Province, have not shown that either groundnuts or sim-sim can be grown in the latter half of the year. This point is being tested in rotation plots under the observation of Agricultural Officers in their districts and in another two seasons it should be possible to formulate a rotation including a maximum of cotton and either one or two other economic crops, for any district in the Province.

The Serere experiment is conducted on sixty sub-plots, of 1/40th acre, as each rotation requires three plots and is repeated five times. The whole sixty plots are scattered at random.

The sowing dates of each crop are arranged at an interval from the harvesting of the previous crop equal to the time which would be taken by one family to do the harvesting and prepare an acre plot. This period is determined by the number of men-days used on the same crop when grown on the Seed Farm.

No results are given in this Annual Report. The experiment was begun in 1929 and cannot be conclusive for some time.

EROSION EXPERIMENT.

This experiment, designed by the Agricultural Chemist, is designed to compare the erosion occurring under various preventive treatments as against native practice where no attempt is made to check erosion.

Lay-out.—The experiment was put down on land sloping enough to provide erosion from rain wash, and the different treatments arranged in 100 yard strips down the slope. The treatments are as follows:—

- A.—Control where no steps are taken to check erosion.
- B.—Cajanus hedge at 100 ft. intervals across the slope.
- C.—Lemon grass hedge at 100 ft. intervals across the slope.
- D.—Surface drain at 100 ft. intervals, at slight angle to the slope and leading into the side drains between the plots.

These treatments are repeated four times, the whole being cropped under a normal rotation and the yields taken from the three sections within each strip. Soil samples are to be taken from each sub-plot once in three years for the period for which the experiment is down. This will be for ten years or more.

COTTON SELECTION.

The cotton breeding work including selection, laboratory examination, progeny rows and the cotton variety trial are carried out by the Assistant Cotton Botanist and an account of the work done at Serere will be found in the Cotton Botanist's report.

B. Work Done on the Seed Farm.

The Seed Farm consists of 80 acres of land, 60 acres of which are under a rotation, 10 acres are for maintenance of seed stocks of minor crops, and 10 acres which will in future be used for tree crops.

The rotation gives :—

20 acres green manure followed by 20 acres cotton.					
10	„	maize	„	„	10 „ „
10	„	groundnuts	„	„	green manure.
10	„	sim-sim	„	„	„ „
10	„	bulo	„	„	„ „

COTTON.

The strain S.G. 23.8 which was grown in a medium bulk increase plot of two acres in the previous year, was planted on the Seed Farm with a view to producing enough seed for the Mulondo Segregated Area in the following year. In actual fact it has been decided to go no further with this particular strain owing to a susceptibility to Jassid attack which made itself apparent in the variety trials. On the Seed Farm it yielded very well and it is apparent that with 30 acres of cotton, two-thirds of which are planted early, there is no difficulty in providing the amount of seed which will plant 400 to 450 acres in Mulondo.

Cotton was planted after the normal cultivations of ploughing in the green manure or maize stubble and disc harrowing. The spacing was 4 ft. by 1½ ft., and three seeds per hole were put in. In each of the 10 acre blocks half the field was planted with seed treated with strong sulphuric acid.

Germination was satisfactory but the young cotton met with severely dry conditions in July. Single ox cultivators were kept in constant use between the rows during early growth. In August a very heavy storm was experienced on the 11th when rain to the amount of 3.34 inches fell in the space of about an hour and a half. The August cotton had just been planted and had to be largely re-sown. After that date conditions were very favourable until the dry weather of November, which caused a great deal of boll shedding. However, the yields obtained were very satisfactory. They are given below :—

					Yield per acre.
					Lbs.
Block 2	(sown June 2nd—8th)	...	...	...	589
„	7 (sown June 30th—July 2nd)	...	...	...	727
„	9 (sown August 11th—14th)	...	...	...	590

The success of the August cotton is quite remarkable, but Block 9 is the most fertile on the farm. The June cotton was much affected by Jassid attack.

Sulphuric Acid Treatment.—The yields of cotton per acre from seed treated with sulphuric acid and from untreated seed are shown below :—

					Treated.	Untreated.
					Lbs.	Lbs.
Block 2	...	...	...	...	566	611
„	7	...	...	...	734	721
„	9	...	...	...	645	536
					648	623

All the cotton had angular leaf spot and blackarm lesions, and the eye could detect no difference between one half of the field and the other in this respect.

The sulphuric acid treatment probably had no effect. The incidence of blackarm is fully discussed in the description of the blackarm experiment.

Total Yield and Quality.—The total yield of S.G. 23.8 cotton from the Seed Farm was 19,068 lbs. seed cotton, of which 3,282 lbs. were stained, or 17 %.

YIELDS OF OIL SEEDS AND GRAIN CROPS.

In addition to the crops grown in rotation with cotton on the Seed Farm those parts of the blocks in the Experiment Farm which are not actually under experiment are also used for production. A summary of the yields on both farms is given below:—

					Yield per acre.	
					Acres.	Lbs.
Groundnuts	...	10	...	(Spreading) unshelled	...	283
Sim-sim	..	10	...		...	94
Maize	...	10	...	(Spring sown) grain	...	1,658
Bulo	...	10	...	Grain	...	2,222

Experiment Farm:—

				Yield per acre.		
				Acres.	Lbs.	
Groundnuts	...	7½	...	(Bunch) unshelled	...	894
Sim-sim	...	3	...	...	...	190
Maize	...	6	...	(Autumn sown) grain	...	1,013

Groundnuts.—The spreading groundnuts were severely affected by the July drought and were so stunted that they were not able to cover the ground. The bunch groundnut was not affected to the same extent. Its short growing period is a very valuable character.

Sim-sim.—Serere is not renowned for high yields of sim-sim in the best years. In the season under review the crop failed on the Seed Farm owing to the July weather assisted by mildew, *Cercospora* and *Rhizoctonia*. The Experiment Farm sim-sim was healthy and looked like giving a big crop but the yield was disappointing.

Bulo (Eleusine coracana).—The weather was entirely favourable. Early rains gave the crop a good start and it grew strongly until the dry spell arrived to ripen off an exceptionally heavy crop.

Maize.—The spring maize was not up to the average though the grain was of very satisfactory quality. The autumn crop had excellent rains early on and produced a better crop than is usually expected. Hickory King seed was used planted at a spacing of 3 ft. by 1 ft.

GREEN MANURES.

The following green manures were used during the year:—

Cajanus indicus sown at 40 lbs. seed per acre makes an excellent cover. It was sown in the spring and ploughed in before early cotton. If left too long it has to be cut back but this can be done several times if required. It was hoped to keep it grazed by cattle but they would not eat it.

Dolichos lablab.—This is the best green manure for the late rains. It produces a good cover and will last through the dry season. This is an advantage in that it is not necessary to plough up the land and leave it bare through this period.

Canavalia ensiformis.—This has been used as a green manure in the spring before cotton on the isolation plots, and in the autumn on the farm. The crop produces a good bulk of material for ploughing in but has to be weeded from time to time. It also tends to become very wiry.

Buckwheat (Fagopyrum esculentum).—This crop, which had been sown at the latter end of 1929, was left to seed itself down during the dry season in order to provide a fresh cover at the break of the rains. Weeds, however, grew too strongly for it and the land had to be ploughed and re-sown. A dry spell occurred soon after germination and the crop did not do well. It is not very suited to Serere conditions.

Bulo (Eleusine coracana).—Bulo sown as a green manure is very useful for covering the land when the rains break and ploughing in about six weeks afterwards, before cotton. One must be in a position to plough it in at the right stage, otherwise the crop becomes too bulky. It was also tried as a self-seeded crop after the bumper crop of bulo on Block 8. A thin seeding of *Dolichos* was put in but this was speedily choked out by the bulo. The latter was then grazed by the cattle who thus obtained good feed at the end of the year when supplies of grass were getting short.

MISCELLANEOUS CROPS.

Small plots of the following crops were grown for stock purposes:—Soya beans gram, Burmese soya beans, *Centrosema pubescens*, *Crotolaria incana*, 40-day maize and various varieties of beans (*Phaseolus* sp.).

Shea Butter Nuts.—Following a visit by a representative of Messrs. Lever Bros., it was decided to investigate the production of Shea nuts. Five acres on Block 1 of the Seed Farm were planted with seeds of the Shea tree (*Butyrospermum*). The seeds were planted at stake. No germination resulted, but good results have been obtained by re-planting with very fresh seed.

EROSION.

Nearly all the land under cultivation at Serere lies on a slope. The formation of erosion channels and the washing away of the surface soil are therefore serious problems. An attempt was made to control this wash by guiding the run off by surface drainage so as to reduce the momentum of the wash. In ploughing, the ridges were set out, not running straight up and down the field, but at a slight angle to the slope of the field. Planting of all line-sown crops was done parallel to the ridges, and at intervals open furrows were left to carry off the water, these furrows being opened by the head ploughman after every storm. On the Experiment Farm this cannot be carried out where experiments with small plots are being done. Here open furrows were made parallel to the long side of the blocks and at right angles to the slope. They were put as near to each other as the size of the plots would allow. Where they were as close as 15 yards there was a considerable measure of control and this system will be compared with the angle system on the Seed Farm in the coming season.

MASS SELECTION.

Mass selection is done on maize, groundnuts and sim-sim with a view to providing sound seed of these crops for distribution, thus to improve the yield and quality of native crops.

In *maize* a good type of Hickory King has been produced and this is being improved by selecting plants which bear their cobs no higher than the seventh node.

In *groundnuts* mass selection of both the bunch and spreading types aims at the production of seed giving high yield and a minimum of rosette affected plants.

In *sim-sim* mass selection is also done but it must be admitted that the results have not been as satisfactory as with maize and groundnuts.

NURSERY WORK.

The Plantation Manager reports that 729 young fruit trees and 19 packets of seeds were distributed during the year. Limes, lemons, soursops, oranges, grape fruit, passion fruit and guavas were most in demand.

GENERAL.

In the Annual Report for 1929 the writer expressed the hope that the opening of the Experiment Farm would allow of useful experimental work being done on it, while leaving the Seed Farm to perform its proper functions of seed production unhampered by experiments on the same land. This hope has been fully realised. The Experiment Farm has proved to be very suitable, none of the experiments having been inconclusive, while the crops on the Seed Farm, though not all good, were very satisfactory as regards cotton production.

SECTION 2.

NGETTA FARM AND SUBSIDIARY EXPERIMENT FARMS.

NGETTA FARM.

This farm, which is maintained out of funds provided by the Native Administration, consists of about 36 acres of land under cultivation. An additional ten acres was cleared for ploughing instruction during the year and may be brought into cultivation in the coming year. A feature of the work at this farm is the recording of the costings or rather man-days employed on native crops. Experimental work supplementary to the work at Serere was carried out on cotton, groundnuts, and maize. Part of the farm was put under the rotation:—

Bulo (Eleusine)
Green Manure
Mutama (Sorghum)
Sweet Potatoes
Kapenda (Cajanus)

for testing as to its suitability for food production in Lango and for observation on costings.

Unfortunately the full programme was not carried out owing to frequent changes of staff, but the table of costings given below was completed. The three crops shown were those not given in the Annual Report for 1929.

SUMMARY OF COSTS OF PRODUCTION OF CROPS ON NGETTA FARM (MAN-DAYS PER ACRE).

TABLE IX.

		<i>Bunch Groundnuts.</i>		<i>Sweet Potatoes.</i>		<i>Kapenda (Cajanus).</i>
First ploughing	...	6	...	—	...	6
Second ploughing	...	5	...	—	...	5
Harrowing	...	2	...	—	...	2
Making mounds	...	—	...	36	...	—
Planting	...	9	...	10	...	1
First weeding	...	17	...	8	...	15
Second weeding	...	7	...	—	...	—
Harvesting	...	40	...	82	...	36
Threshing	...	—	...	—	...	5
TOTAL MAN-DAYS	...	86	...	136	...	70
YIELD PER ACRE	...	852 lbs.	...	—	...	719 lbs.

TABLE IXA.

DISTRIBUTION OF LABOUR PER MONTH (PER ACRE).

		<i>Bunch Groundnuts.</i>		<i>Sweet Potatoes.</i>		<i>Kapenda.</i>
January	...	—	...	82	...	5
February	...	—	...	—	...	—
March	...	—	...	—	...	—
April	...	6	...	—	...	11
May	...	16	...	—	...	11
June	...	17	...	—	...	4
July	...	7	...	—	...	3
August	...	—	...	—	...	—
September	...	40	...	46	...	—
October	...	—	...	8	...	4
November	...	—	...	—	...	18
December	...	—	...	—	...	14
TOTAL MAN-DAYS	...	86	...	136	...	70

The high cost in man-days of harvesting sweet potatoes includes the cutting and drying for storage. This is customary with sweet potatoes planted in September but with earlier crops the potatoes are eaten fresh so that harvesting is confined to the digging of the roots.

The costs of production of cotton, bulo, maize, and spreading groundnuts were determined for the second time. The results are not given here as it is intended to average the figures obtained after a few years thus to obtain data upon which to base an agricultural policy for the peasant.

COTTON SOWING DATE AND SPACING TRIAL.

This experiment combined nine sowing dates from July 28th to September 8th with the two spacings 3 ft. by 1 ft. and 4 ft. by 1½ ft. The results were very similar to those obtained at Serere as regards sowing date, the earlier dates producing significantly better yields than the later ones. In the case of the spacings the mean of the 3 ft. by 1 ft. plots was greater than that of the 4 ft. by 1½ ft. plots on all dates except one although statistical significance was not obtained. The experiment is to be repeated in 1931 and results will be given in the next Annual Report.

Groundnut Spacing Trial (Spreading Type).—This experiment was conducted with spreading groundnuts whereas the Serere experiments have been done with the bunch type.

The three spacings 2 ft. by 1 ft., 2 ft. by 2 ft., and 1 ft. by 1 ft. were planted in lines and broadcast, making six treatments which were replicated five times in randomised blocks.

Results.—

TABLE X.
MEAN YIELDS IN LBS. UNSHELLED GROUNDNUTS.

<i>Spacing.</i>		<i>Lines.</i>		<i>Broadcast.</i>		<i>Mean.</i>
2 ft. by 2 ft.	...	72.2	...	63.8	...	68.0
2 ft. by 1 ft.	...	92.4	...	83.8	...	88.1
1 ft. by 1 ft.	...	84.8	...	87.0	...	85.9
MEAN	...	83.2	...	78.2	...	80.7

The results satisfy the Z test when $P=0.01$ and differences of 12.22 are significant.

Conclusions.—While the difference between line sowing and broadcasting is not big enough for statistical significance at any of the spacings used both 1 ft. by 1 ft. and 2 ft. by 1 ft. are significantly greater than 2 ft. by 2 ft. spacing. The 2 ft. by 2 ft. spacing is definitely too wide.

KAMUGE LUKIKO FARM.

The work at this farm of six acres was re-organised so as to provide a plot for a cotton variety trial every year in a rotation which will keep up the fertility of the soil. The rest of the farm is under the standard rotation proposed for the Eastern Province. The farm is situated in Bugwere district near to an important native centre.

BUBULU LUKIKO PLANTATION.

This is also a small farm supported by funds from the Native Administration. The chief work here is again the testing of the standard rotation and one variation of it in which sim-sim and maize change places so that the result of growing either crop in the autumn is being observed. There is also a plot of *Arabica* coffee and this plantation could be used for extension work in connection with the Bugusege experiments when the Agricultural Officer for Bugishu is stationed in Bubulu.

SECTION 3.

DISTRICT EXPERIMENTAL WORK.

ROTATION PLOTS.

These rotation plots are extensions to the Rotation Experiment at Serere. In most cases they consist of three plots of one-quarter acre each on which the standard rotation as at "A" on page 12 is tested. These rotation plots are situated at county headquarters in Lango and Teso and the rotation is also being tested on the farms at Ngetta, Kamuge and Bubulu.

Supplementary to these trials are the sowing date strips at Simsa and Katakwe in which the best times for planting cotton, bulo, groundnuts and sim-sim are tested in 1/20th-acre strips planted fortnightly from March 14th to May 14th and again from July 14th to September 14th. Cotton has its own dates, May 14th to July 14th only.

COTTON EXPERIMENTS.

Variety Trials.—These, of which there were three in Lango, four in Teso, and one each in Bugwere and Busoga, are reported on by the Cotton Botanist.

One-quarter Acre Comparison Plots.—There were thirty-nine of these adjacent pairs of one-quarter acre plots scattered evenly throughout the Eastern Province during the year under review. The variety tested against N. 17 was the new strain S.G. 23.8. The yield figures and seed cotton samples were handed over to the Cotton Botanist, who reports on them.

Cotton Spacing Trials in Busoga.—While spacing experiments have been conducted for some years in the central and northern districts of the Eastern Province little has yet been done in Busoga where the soil, being red loam, and the rainy season longer, different conditions for growth occur. Preliminary spacing trials were put down at Ndulya, Buluya and Vukula. The spacings 4 ft. by 1 ft., 4 ft. by 2 ft., 3 ft. by 1 ft. and 3 ft. by 2 ft. were tried in replicated plots at each centre. The experiments are to be continued in 1931.

COTTON RIDGING EXPERIMENT.

Object.—To test the effect of ridging cotton in the Usuku area of Teso district where the plants do not reach the normal size, possibly owing to a pan or other cause preventing root growth.

Lay-out.—The experiment was carried out by putting down a two by two Latin square of ridged and flat plots at five centres in the area. Each sub-plot consisted of 17 rows planted at 3 ft. by 1 ft., the dimensions being 51 ft. by 51 ft. The ridges were 2 ft. high. Three seeds per hole were sown and blanks were re-sown twice. The plots were planted in June but those at Katakwe were destroyed by hail and had to be planted again in August.

Yields.—

TABLE XI.

MEAN YIELDS OF TWO PLOTS IN LBS.

<i>Place.</i>					<i>Flat.</i>		<i>Ridged.</i>
Katakwe	...	...	...	...	20.5	...	30.0
Toroma	...	...	...	...	38.0	...	38.5
Amussia	...	...	...	...	40.5	...	41.5
Magoro	...	...	...	...	73.0	...	71.5
Nariama	...	...	...	...	59.5	...	58.0
MEAN	...	...	...	...	46.3	...	47.9
MEAN WITHOUT KATAKWE	...	...	...	...	52.7	...	52.3

The Katakwe plots are not comparable with the rest because of the later planting. In the calculation of the Katakwe results it was found that the random errors are greater than those due to treatment.

Conclusions.—The mean yield of cotton on the ridged plots is very close to the yield on the flat plots among the four centres planted with early cotton. There would appear to be no advantage to be had by ridging the land for cotton.

Although there is a large apparent difference in favour of the ridged cotton at the centre planted in August no importance attaches to the results.

GROUNDNUT EXPERIMENT AT KATAKWE AND TOROMA.

Objects.—(1) To obtain information as to the best spacing for spreading groundnuts.

(2) To compare the merits of ridging, line sowing, and broadcast sowing of spreading groundnuts.

(3) To compare the yields of bunch groundnuts with spreading groundnuts.

The soil of the Usuku area being very sandy is very suitable for groundnut cultivation and the crop is an important one there and is capable of considerable development. The groundnut in cultivation is the spreading variety which yields well, but the bunch groundnut has the great advantages of its short growing period and its ease of harvesting which would enable it to be used more easily in rotation with cotton should its yield prove satisfactory.

Lay-out.—The treatments were—

Spacing	3 ft. by 1 ft. in lines with spreading groundnuts.				
"	1½ ft. by 1½ ft.	"	"	"	"
"	2 ft. by 1 ft.	"	"	"	"
"	2 ft. by 1 ft. broadcast	"	"	"	"
"	3 ft. by 1 ft. ridged	"	"	"	"
"	2 ft. by 1 ft. in lines with bunch groundnuts.				

Five replications were used in randomised blocks at Katakwe and Toroma and the two experiments have been treated as if they were one, thus giving ten repetitions. The sub-plots were 70 ft. by 30 ft. The experiment was planted on April 12th and harvesting took place on July 15th in the case of the bunch groundnuts. The spreading variety was harvested on August 11th thus showing a difference in growing period of 27 days. In this particular experiment the earliness of the bunch type proved to be disadvantageous in that ground squirrels attacked the ripening plants. If a large acreage were in cultivation no doubt this damage would not be very serious, but there is no doubt that the yield of the bunch plots in the experiment was reduced.

Results.—

TABLE XII.

(Katakwe and Toroma Groundnut Experiment Combined).

MEAN YIELDS OF TEN PLOTS IN LBS. UNSHELLED.

Spacing.	Spreading Groundnuts.			Bunch Groundnuts.
	Lines.	Broadcast.	Ridged.	
3 ft. by 1 ft.	25.1	—	23.4	—
1½ ft. by 1½ ft.	30.8	—	—	—
2 ft. by 1 ft.	33.2	34.0	—	24.3

In the analysis of variance the experiment is shown to be significant when $P=0.01$, and the following significant differences occur between comparable treatments, the value of "t" being 6.28:—

2 ft. by 1 ft. line sown is better than 3 ft. by 1 ft. line sown.

2 ft. by 1 ft. line sown spreading is better than 2 ft. by 1 ft. line sown bunch.

The spacing 1½ ft. by 1½ ft. is nearly significantly better than the 3 ft. by 1 ft. spacing with the spreading groundnut and in view of the fact that some of the bunch plots had been attacked by ground squirrels thus causing great variation within one treatment the experimental results were again worked out omitting the bunch plots. This reduces the standard error and the mean yield of the 1½ ft. by 1½ ft. plots becomes significantly greater than the 3 ft. by 1 ft. spacing.

Conclusions.—

Spacing.—3 ft. by 1 ft. spacing is too wide and 2 ft. by 1 ft. or 1½ ft. by 1½ ft. gives a higher yield with spreading groundnuts.

Cultivation.—There is no advantage in line sowing over broadcasting at 2 ft. by 1 ft. or in ridging over flat cultivation at 3 ft. by 1 ft. with spreading groundnuts.

Variety.—At Katakwe and Toroma there is some evidence to show that the spreading type of groundnut is a heavier yielder than the bunch groundnut when both are planted at 2 ft. by 1 ft. spacing.

SECTION 4.

BUGUSEGE COFFEE PLANTATION.

This plantation, which is entirely devoted to experimental work with *Arabica* coffee, is situated in Bugishu, a district which now has an acreage of 1,600 acres of coffee under cultivation by natives, with prospects of a considerable increase in the near future. The Plantation is at an elevation of 5,064 feet. The area is roughly 17 acres of which the first experiment was planted in 1927. At the end of the coming year the whole area will have been put down to experimental work, the object of which is to obtain information leading to the improvement of coffee under native cultivation by methods suitable to the capability of the native.

The first experiment put down was designed to test the two main plantation pruning systems against the single stem system under which the first native coffee plots were pruned. Later it seemed desirable to find a simpler method than either the Agobiada or the multiple stem system and a second experiment was put down which includes a modified multiple stem pruning system which may prove simple enough for a native to carry out. A third experiment contains various manurial and cover treatments, including the one which growers are at present advised to follow, namely, the banana leaf mulch. These experiments are described in detail below.

PLANTATION PRUNING EXPERIMENT.

Object.—To compare the yields of coffee pruned on the single stem, multiple stem, and Agobiada systems.

Lay-out.—The three treatments are laid out in five randomised blocks, making fifteen plots in all. The spacing adopted is 8 ft. by 8 ft. with seven rows of 8 trees, or 56 trees per plot.

The experiment was planted in 1927 and the trees under the different pruning systems were treated as follows:—

Single stem trees—topped at five feet in May, 1929.

Multiple stem trees—first cut made at 2 ft. 6 ins. from the ground in November, 1928.

Agobiada trees—tied down in December, 1928.

The whole experiment has been mulched with banana leaves.

Results and Discussion.—The first pick was made at the latter end of 1929 and the second crop was taken from August onwards in 1930. The following table gives the yields:—

TABLE XIII.
MEAN YIELDS OF FIVE PLOTS IN LBS. OF CHERRY.

					Agobiada A	Multiple Stem M	Single Stem S
1929	...	...	...	...	87.0	79.6	123.3
1930-31	...	...	...	...	606.8	427.6	347.3
TOTAL					693.8	507.2	470.6

In the analysis of variance done on the total yields the variance due to treatment is significant when $P=0.01$ and the following results are apparent:—

TABLE OF COMPARISONS.

Comparison.	Observed difference.			The value of a significant difference being 117.3 when $P=0.01$.	
M—S	...	36.6	...	...	Not significant.
A—M	...	186.5	...	...	Significant.
A—S	...	223.2	...	...	Significant.

In the analysis of variance for the first pick the single stem treatment was significantly greater than Agobiada when $P=0.05$.

Thus at first the single stem trees showed a marked superiority over trees pruned on the Agobiada method, but topping at 5 ft. has so reduced the leaf area as to prevent the tree from recuperating after bearing a crop, die-back has occurred on all the trees, and many of them are dead.

Returning to the mean totals of the two picks it is seen that the Agobiada treatment is significantly better than the other two pruning systems. It will be interesting to see the effect of the coming crop, which will be a heavy one, on the Agobiada trees. Until several more crops have been taken it would be wrong to draw conclusions but under Bugusege conditions it would appear that the single stem system is unsatisfactory and the Agobiada system the most promising.

COFFEE MANURING EXPERIMENT.

Object.—To compare the yield from coffee manured in various ways, covered, or clean weeded. The treatments are given below:—

- A. Clean weeded.
- B. Green manure—two covers a year.
- C. Banana leaf mulch.
- D. Ordinary weed cover.
- E. Leguminous cover crop—October to March and clean weeded for the rest of the year.

The latter treatment is an attempt to make use of the theory that an increase in the carbon/nitrogen ratio of the plant's intake induces reproductive growth, while the decrease in this ratio results in more vegetative growth. The Bugishu coffee crop flowers in the early part of year and has set most of its flowers by the end of February. It is ripening its berries until November when the main picking takes place.

Lay-out.—The experiment is planted as a five by five Latin square of plots with five rows of eight trees spaced at 8 ft. by 8 ft. and pruned on the single stem system. It was planted in June, 1928. In view of the failure of the single stem trees in the pruning experiment a head is now being allowed to grow up so as to provide additional leaf area.

The green manure used in treatment "B" is Canavalia dug in twice a year. Dolichos lablab is grown on treatment "E," sown in October and dug in March. The banana leaf mulch is obtained from native plantain gardens, the dry leaves being spread on the ground to a depth of several inches.

Results.—One crop has been picked and the yields are given below.

TABLE XIV.
MEAN YIELD OF FIVE PLOTS IN LBS. OF CHERRY.

A. Clean weeded ...	...	...	...	...	189.9
B. Green manure—two covers a year	...	...	...	...	183.6
C. Banana leaf mulch	...	...	...	...	168.1
D. Ordinary weed cover	...	...	...	...	205.0
E. Leguminous cover crop, October—March	...	...	...	...	191.6

No conclusions can be drawn from the first pick of a coffee experiment and the differences are in fact not significant. At the time of writing the weed cover plots are noticeably yellow but the trees on treatment "E" are promising. However, conclusions must wait on further results.

PRUNING EXPERIMENT FOR NATIVES.

Object.—Reference is made to the subject of pruning in the opening statement with regard to Bugusege Plantation and to the failure of the single stem method in the plantation pruning experiment. Similar die-back has occurred in native grown coffee at the lower altitudes and this experiment is designed to test a simple multiple stem against the single stem and against natural growth.

Lay-out.—The three treatments are—

- Modified multiple stem,
- Single stem,
- Natural growth.

They are repeated six times in randomised blocks. The plots contain six rows of trees each spaced at 8 ft. by 8 ft. In the modified multiple stem system the trees are topped in the nursery, that is, the terminal bud is nipped out at about a month before planting out when the plants are 6 ins. to 8 ins. high. The two resulting stems are to be allowed to grow and crop until they are 5 ft. high. One of the two leaders is then to be cut back and two more suckers allowed to grow up from the base. Periodically the oldest of the three main axes will be cut back to the base and one fresh sucker allowed to grow up and take its place. Thus the tree will never have more than three main stems, all three being allowed to make natural growth with no pruning.

This experiment was planted in August, 1930.

NEW EXPERIMENTS.

Clearing of land for planting more experiments was begun and these will be put down in 1931. They will be:—

(1) *Shade Experiment*.—Two types of shade will be used: (1) Permanent shade of bamboo slats; (2) Seasonal shade in which the bamboo slats are removed

- (a) One month before flowering.
- (b) One month earlier than (a).
- (c) One month earlier than (b).

The slats will be removed gradually so as to simulate the leaf fall of a deciduous tree and in the meantime observations are being made on various types of deciduous trees.

(2) *Spacing Experiment*.—The standard spacing now advised for Bugishu is 6 ft. by 6 ft. as the 8 ft. spacing is apparently too wide. However, the best spacing has not yet been experimentally proved and the spacing experiment will test 4 ft. by 4 ft., 6 ft. by 6 ft., 7 ft. by 7 ft. and 8 ft. by 8 ft., spacings both under conditions of natural growth and modified multiple stem pruning.

(3) *Manuring Experiment*.—This is a repetition and amplification of the manuring experiment already in existence to be carried out with trees pruned on the modified multiple stem system. It will include two new treatments: (a) mulching with split banana stems, (b) the use of *Leucaena glauca* as a mulch. Lines of this plant will be sown between the coffee in both directions. Where they intersect the trees will be allowed to grow up and act as shade. The remainder will be cut back, the loppings being used as a mulch.

(4) *Variation in Yield*.—There is little evidence available with regard to the best size of plot for experimental work in coffee. In order to ascertain the variation in yield from tree to tree a plot of 200 trees is being planted for single tree yield determination.

SUMMARY.

1. Cotton sowing date and spacing trials conducted at Serere, Ngetta and in Busoga. They confirm the value of early planting at the first two places. The spacings 4 ft. by 1½ ft. and 3 ft. by 1 ft. were used except in the Busoga trials, which were preliminary. The experiments are described in Sections 1 (A), 2 and 3.

2. An experiment designed to test the advisability of introducing fresh seed into areas where the cotton has failed in the previous year from blackarm was put down at Serere. Section 1 (A).

3. No advantage was gained by ridging cotton in Usuku. The experiment is described in Section 3.

4. A sub-soiling experiment for cotton is described in Section 1 (A). No advantage was shown.

5. Yields of cotton on the Seed Farm were high. Sulphuric acid treatment of the seed produced no visible difference over five acre plots. See Section 1 (B).

6. Yield figures from thirty-nine pairs of one-quarter acre comparison plots were handed over to the Cotton Botanist. See Section 3.

7. Groundnut spacing and cultural trials were conducted at Serere, Ngetta, and in Usuku, and are described in Sections 1 (A), 2 and 3 respectively. In general 3 ft. by 1 ft. and 2 ft. by 2 ft. spacings were found to yield less than 2 ft. by 1 ft. or 1½ ft. by 1½ ft. spacings in both spreading and bunch groundnuts. There is an indication that 1 ft. by 1 ft. is the best spacing for bunch groundnuts.

8. Bunch groundnuts included in the Usuku groundnut trials yielded less than spreading groundnuts at the same spacing, 2 ft. by 1 ft., but this may not be the optimum spacing for the former. *See* Section 3.

9. A maize spacing trial combined with one and two plants per hole was planted at Serere. 3 ft. by 2 ft. and 3 ft. by 1 ft. spacing gave higher yields than 2 ft. by 1 ft. 9 ins. and leaving two plants per hole depressed the yield. Observations on cob weight and grain weight are made. *See* Section 1 (A).

10. The effect of sub-soiling on maize was to reduce the yield. *See* Section 1 (A).

11. In the sim-sim sowing date and seed rate trial at Serere the indications were that the optimum time is not later than early April and that 7½ lbs. or 10 lbs. per acre give better yields than lower seed rates. *See* Section 1 (A).

12. The permanent rotation experiment at Serere is described in Section 1 (A), extension work in this connection at Kamuge and Bubulu in Section 2, and district rotation plots in Section 3.

13. The Agricultural Chemist's Erosion Experiment is described in Section 1 (A).

14. Yields of crops, observations on green manures and the work of the seed farm will be found in Section 1 (B).

15. Costings of bunch groundnuts, sweet potatoes, and Cajanus, as determined at Ngetta Farm, are given in Section 2.

16. Section 4 is entirely devoted to experiments with *Arabica* coffee at Bugusege plantation. Pruning, manuring, shade and spacing experiments are described.

C. E. J. BIGGS,

Acting Senior Agricultural Officer.

ANNUAL REPORT, BUKALASA EXPERIMENT STATION, 1930—31.

METEOROLOGICAL.

Rainfall.—The rainfall in April was very heavy and resulted in the rapid spread of leaf spot (*Cercospora*) in the bean and cowpea crops, and the latter crop was completely destroyed by this disease.

The June rainfall was slightly above normal and the weather during that month was ideal for cotton planting, but the July and August rainfall was not well distributed, resulting in poor germination of the cotton sown during those months.

The September rainfall was above normal, but that of the last three months was much below normal with the result that the August sown cotton suffered badly from water-starvation.

MONTHLY RAINFALL FOR 1930 IN INCHES.

			Average for preceding 9 years.		Difference from normal.	
		Total Inches.		Inches.		Inches.
January	...	1.47	...	1.43	...	+0.04
February	...	1.91	...	2.20	...	—0.29
March	...	5.21	...	4.61	...	+0.60
April	...	8.50	...	6.36	...	+2.14
May	...	3.03	...	5.40	...	—2.37
June	...	3.86	...	3.58	...	+0.28
July	...	2.88	...	3.85	...	—0.97
August	...	3.61	...	4.58	...	—0.97
September	...	6.54	...	4.79	...	+1.75
October	...	4.87	...	7.03	...	—2.16
November	...	1.90	...	5.75*	...	—2.85
December	...	2.59	...	3.10	...	—0.51
		46.37	...	52.68	...	—5.31

Temperatures.—The temperatures during the first three months of the year were much below normal. During the latter half of the year temperatures above the average were registered.

		Mean maximum.	Highest temperature.		Mean minimum.	Lowest temperature.		
		°F.	°F.		°F.	°F.		
January	...	81.2	...	86	...	60.5	...	54
February	...	83.7	...	91	...	61.5	...	59
March	...	79.0	...	88	...	61.9	...	60
April	...	78.0	...	86	...	61.8	...	59
May	...	81.1	...	85	...	61.8	...	58
June	...	78.3	...	88	...	53.3	...	51
July	...	80.7	...	85	...	53.5	...	49
August	...	82.0	...	85	...	52.4	...	50
September	...	82.6	...	88	...	53.5	...	57
October	...	83.2	...	88	...	58.2	...	52
November	...	85.5	...	88	...	59.8	...	56
December	...	85.3	...	90	...	58.8	...	55

GENERAL.

Owing to the fact that the delivery of the plough and tractor was somewhat delayed, the planting of the food crop experiments in the spring rains of 1930 was held up. This resulted in a large proportion of the cotton crop being planted late in August; the optimum planting months, June and July, were missed, and yields of cotton were, in consequence, low.

In the spring rains, a number of golden crested cranes made the plantation their feeding ground. It was at first thought that the poor stands obtained in the maize and groundnut experiments were due to bad seed or other causes. After the gaps had been resown these birds were seen to be following the rows and picking out all the seed. As a result, all the groundnut and maize experiments were failures owing to the poor stand of plants obtained.

In 1929 it was noticed that the root and shade effect of the *Cedrela Toona* trees along the two main and cross avenues was so great that small plot experiments could not be conducted within at least fifty feet of these trees. All the *Cedrela* trees in the cross avenues were therefore cut out, and it was decided to leave a 100 ft. strip between the main avenues and the experimental plots. These strips are being used for the planting up of various fodder grasses, and for small plots for increase of green manures and cover crops. The area remaining, free from tree effect, consists of four blocks, of five acres each, available for permanent experiments.

The rotation formerly adopted had been designed to include as large an area as possible under cotton, the seed from which would be used in the first stage of any scheme for the introduction of new cotton seed into Buganda Province. As this is no longer required a better balanced rotation, embodying certain definite experiments, has been adopted. These experiments include trials of cultural operations with the main economic crops, and suitable areas have been set aside for selection and increase work on the major food crops.

During the year, owing to the development of the agricultural school for the training of elementary schoolmasters, it was necessary to open up fresh land for a school garden, nurseries, and an area which has been put under plantains to serve as a source of food supply to those taking the course.

The transfer of the Cotton Botanist from Serere to Bukalasa has necessitated the allocation of land for the development of work in this section. Land has been cleared for cotton breeding, isolation and increase plots.

The resident labour, which had previously been scattered over the unused portions of the farm, was allocated an area of 28 acres on that part of Bukalasa which is of least use for experimental purposes. Each man is provided with a house and half-an-acre of land on which to grow his food crops.

The removal of the labour from their scattered plots to the new labour lines caused very little unrest.

The supply of labour has been plentiful throughout the year.

A caterpillar 10 h.p. tractor, Ransome's "Hussar" two-furrow disc plough and Killefer subsoiler were delivered in March. These implements have done excellent work.

Cost of ploughing with this tractor and plough is as under:—

6 $\frac{3}{4}$ acres of land previously cultivated, ploughed to a depth of 8 inches in dry weather during August.

					Shs.	Cts.
Labour—12 hours @ cts. 50 per hour	...	...	...	...	6	00
Kerosene—16 gallons	...	...	...	...	31	04
Gasoline— $\frac{1}{4}$ gallon...	...	...	...	...	0	80
Oil— $\frac{1}{2}$ gallon	...	...	...	...	3	00
Depreciation at Shs. 2/- per hour	...	...	...	...	24	00
TOTAL					64	84

Cost per acre = Shs. 9/60.

COTTON.

Sowing Date and Spacing Experiment.—An experiment designed to determine the optimum sowing date combined with the optimum spacing for each sowing date for those areas of which Bukalasa is typical.

When this experiment was started, it was thought that the optimum sowing date for this area lay between the middle of July and the middle of August. It was decided to test three sowing dates, namely, mid-July, the end of July, and mid-August, together with four spacings, 4 ft. by 2 ft., 3 ft. by 2 ft., 4 ft. by 1 ft., and 3 ft. by 1 ft. The lay-out of the experiment was a random scatter of sixty plots, each treatment being repeated five times.

The results of the first three years showed that the mid-July sowings gave the highest yields, so in 1929 it was decided to include an earlier sowing date, namely, mid-June, and to omit the end of July sowing date.

During the 1929-30 season excessive rains fell in December and January. Owing to these adverse weather conditions and to a severe attack of blackarm disease,

very poor results were obtained from the experiment; no cotton was harvested from the August sown plots, only one picking from the July and four pickings from the June sown plots were obtained.

During the 1930-31 season, the period October to December was much drier than normally, and the late sown cotton was scarcely far enough advanced to withstand the drought.

EXPERIMENTAL RESULTS.

Layout.—A random scatter of sixty plots.

Area of each Plot.—2/51 acres, after cutting out outside rows, and balancing for the different spacings.

1929-30.						1930-31.			
	Totals 5 Plots.	Means.	Equiva- lent to lbs. per acre.	Percent- age of means.		Totals 5 Plots.	Means.	Equiva- lent to lbs. per acre.	Percent- age of means.
JUNE :—	<i>lbs.</i>	<i>lbs.</i>	<i>lbs.</i>		<i>lbs.</i>	<i>lbs.</i>	<i>lbs.</i>		
4 ft. by 2 ft. ...	28	5.6	142.8	154.2	169	33.8	861.9	131.6	
3 „ by 2 „ ...	31	6.2	158.1	171.0	157	31.4	800.7	122.0	
4 „ by 1 „ ...	26	5.2	132.6	145.1	167	33.4	851.7	130.0	
3 „ by 1 „ ...	28.5	5.7	145.4	157.0	200	40.0	1,020.0	155.5	
JULY :—									
4 ft. by 2 ft. ...	10	2.0	51.0	56.1	120	24.0	612.0	93.6	
3 „ by 2 „ ...	6	1.2	30.6	33.1	119	23.8	606.9	92.8	
4 „ by 1 „ ...	7.5	1.5	38.3	41.4	129	25.8	657.9	100.0	
3 „ by 1 „ ...	8	1.6	40.8	44.1	134	26.8	683.4	104.1	
AUGUST :—									
4 ft. by 2 ft. ...	...	...	...	...	73	14.6	372.3	56.9	
3 „ by 2 „ ...	...	...	...	...	84	16.8	428.4	65.4	
4 „ by 1 „ ...	...	...	...	...	101	20.2	515.1	78.8	
3 „ by 1 „ ...	...	...	...	...	88	17.6	448.8	68.5	
MEANS	...	3.635	92.7	100.0	...	25.7	655.35	100.0	
S. E.	±3.52	±0.704	...	±19.5	±9.1	±1.82	...	±7.68	

Owing to the lay-out of the experiment the standard errors were worked out by Engledow's method.

In the 1929-30 season the June sown cotton gave a significantly greater yield than the rest, but there was no significant difference due to spacings.

In the 1930-31 season the following results were significant:—

June sown—3 ft. by 1 ft. spacing, over all.

" " 4 ft. by 2 ft., 4 ft. by 1 ft. and 3 ft. by 2 ft. spacing, over all July and August sown.

July sown—3 ft. by 1 ft. and 4 ft. by 1 ft. spacings over all August sown.

" " 4 ft. by 2 ft., and 3 ft. by 2 ft. spacings, over August sown 4 ft. by 2 ft., 3 ft. by 2 ft. and 3 ft. by 1 ft. spacings.

August sown—4 ft. by 1 ft. spacings, over August sown 4 ft. by 2 ft. spacings.

Conclusions.—The past two years show that, of the three sowing dates, June is probably the optimum, while the 1930-31 experiment indicates that 3 ft. by 1 ft. spacing gives a greater yield than either the 3 ft. by 2 ft. or 4 ft. by 1 ft. spacings at all sowing dates with the exception of August.

SUBSOILING EXPERIMENT.

In many areas of Uganda, the soil underlying the first nine to twelve inches of top soil is a compact and, to some extent, impervious clay. In consequence root development of deep rooting crops is abnormally restricted, with a probable reduction in cropping. This is seen particularly in cotton where the normal deep tap root is often absent and is replaced by a mass of surface roots. Root development of this nature

makes the crop very susceptible to climatic changes, and may increase bud and boll shedding. In order to test the effect of deep cultivation it was decided to test the effect of subsoiling on cotton and other crops. For this purpose a two-acre plot possessing a clay sub-soil was chosen, and divided into 24 strips in the A BB AA BB . . A pattern, the area of each strip harvested being 1/11th acre. Twelve strips were subsoiled to a depth of 12 inches with a tractor-drawn Killefer subsoiler, and the whole plot was then ploughed to a depth of 8 inches.

Cotton was planted on the 16th August in dry weather. On the 26th November, 15 plants in each of twelve strips, taking every tenth plant, were pulled up and the roots examined and measured—it was found that there was a significantly greater number of twisted taproots in the control plots than in the sub-soiled plots, while the taproots of the cotton in the subsoiled plots were of significantly greater length.

1. Observations of Root Length and Shape.—

	Subsoiled.	Control.	Mean.	S. E.
Root length ...	19 cms.	15.8 cms.	17.4 cms.	±9.3674
Twisted taproot ...	5	8.6	6.75	±0.625

2. Results.—

YIELDS OF COTTON.

	Subsoiled.	Control.	Mean.	S. E.
Total of 12 strips ...	488 lbs.	438 lbs.	463 lbs.	±14.52
Means ...	40.7 "	36.5 "	38.5 "	± 1.21
Equivalent to lbs. per acre ...	447.7 "	401.5 "	423.5 "	—
Percentage of Means ...	105.4	94.6	100	± 3.14

Standard Error calculated by Fisher's method.

The yields obtained from the subsoiled plots are significantly greater than those from the control plots.

Conclusions.—On land possessing a clay subsoil, the operation of subsoiling in preparation for cotton results in the formation of a better developed taproot, and there is a tendency for greater crop production from the subsoiled plots.

INTERPLANTING EXPERIMENT.

1. To determine the effect of interplanting cotton with various crops: There are several advantages which, it would seem, might be gained by interplanting with low growing leguminous crops such as beans and groundnuts; the soil would be more completely covered, thus preventing soil wash and conserving humus, and at the same time two crops would be obtained from the same plot. Against this, it is possible that the competition for water and food by the interplanted crops might adversely affect the yields of the cotton. If interplanting proves advantageous, it is necessary to determine the optimum time, in relation to the cotton, for sowing the interplanted crop.

A two-acre plot was divided into a six by six Latin square and planted with cotton at a spacing of 4 ft. by 2 ft. on 22nd August. Six treatments were tried, namely:—

1. Interplanting with beans on 22nd August.
2. Interplanting with groundnuts on 22nd August.
3. Interplanting with beans on 22nd September.
4. Interplanting with groundnuts on 22nd September.
5. Clean weeding: Control.
6. Slashing of weeds.

In its early stages, the cotton on the plots where weeds were kept slashed made less growth than in the other treatments; there was no noticeable difference in growth

between the other five treatments until the dry spell, from mid-October to mid-November, when the cotton in the interplanted plots seemed to suffer from drought more than in the clean weed plots.

Results.—

COTTON YIELDS.

		<i>Treatments.</i>														
		1	2	3	4	5	6			<i>Means.</i>						
		<i>lbs.</i>	<i>lbs.</i>	<i>lbs.</i>	<i>lbs.</i>	<i>lbs.</i>	<i>lbs.</i>			<i>lbs.</i>	<i>S. E.</i>					
Totals of 6 plots	...	56.8	...	78.0	...	94.8	...	85.8	...	111.0	...	46.8	...	79.2	...	±5.754
Means	...	9.8	...	13	...	15.8	...	14.3	...	18.5	..	7.8	...	13.2	...	±0.959
Equivalent to lbs. per acre	196	...	260	...	316	...	286	...	370	...	156	...	264	...	—	
Percentages	...	74.4	...	98.3	...	119.8	...	108.5	...	140	...	59	...	100	...	±7.256

2. Yields of Interplanted Crops :—

	<i>Early Beans.</i>	<i>Early Groundnuts.</i>	<i>Late Beans.</i>	<i>Late Groundnuts.</i>
Means	... 13.2 lbs.	... 24.8 lbs.	... 8.5 lbs.	... 23.1 lbs.

Conclusions.—The results show that cotton in the control plots gave a significantly greater yield than the other treatments, while treatment 3 was significant over treatments 1, 2, and 6; treatment 2 over 1 and 6; and treatment 1 over 6. The cotton was late planted and, if the limiting factor in the interplanted plots was water, it is quite probable that the differences in yields would be less in early sown cotton.

MULCHING EXPERIMENT.

1. One of the greatest needs in present native agricultural practice is to find some practical means of preventing, in so far as is possible, soil erosion, and of maintaining soil fertility. In elephant grass country the possibilities of mulching with this grass need investigation, and for this purpose the following experiment was laid down in 1930.

A $1\frac{1}{2}$ -acre plot was divided into four random blocks of two sub-plots each, the area of each sub-plot being $1/6$ th acre. Cotton was sown in all the plots on 31st July at a spacing of 4 ft. by 2 ft. and half the plots were mulched with elephant grass to a depth of 3 inches, the remainder being clean weeded as controls.

In October, during a spell of dry weather, there was a distinct yellowing of the leaves of the cotton in the mulched plots, possibly owing to excessive surface root development due to the mulch, resulting in water starvation during the dry weather.

All the mulched plots gave higher yields than their corresponding controls, and, although the difference in the means is nearly four times the standard error as worked out by Fisher's method, the result is shown to be not significant by Table "Z" owing to insufficient repetitions.

(2) *Results.*—

YIELDS OF COTTON.

		<i>Mulched Plots.</i>		<i>Controls.</i>		<i>Means.</i>		
		<i>lbs.</i>		<i>lbs.</i>		<i>lbs.</i>		<i>S. E.</i>
Totals of 4 plots	...	532	...	405	...	468.5	...	±33.47
Means	...	133	...	101.5	...	117.1	...	± 8.3675
Equivalent to lbs. per acre	...	798	...	609	...	702.6	...	—
Percentages	...	113.7	...	86.3	...	100	...	± 7.15

BLACKARM EXPERIMENT.

An experiment designed by the Mycologist for observations on the germination and yields of cotton the seed of which had been obtained from blackarm infected areas, as compared with that obtained from disease free areas.

Seed was obtained from the following localities :—

- Katakwe: A badly infected area.
- Bulemezi: A slightly infected area.
- Bukalasa: An infected area.
- Kampala: A disease free area.
- Mukura: A disease free area.

The lay-out used was a five by five Latin square, the area of each plot being $1/36$ th acre.

The cotton was planted in the middle of August at a spacing of 4 ft. by 2 ft., six seeds per hole being sown. At the time of thinning out, a count of the stand was taken with the following results:—

NUMBER OF BLANKS.

		<i>Katakwe.</i>		<i>Bulemezi.</i>		<i>Bukalasa.</i>		<i>Kampala.</i>		<i>Mukura.</i>		<i>Mean.</i>		<i>S. E.</i>
Mean	...	65.4	...	44.8	...	71.4	...	80	...	34.8	...	59.28	...	±11.1
Percentages	...	110.5	...	75.7	...	120.3	...	134.9	...	58.7	...	100	...	±18.9

The stand from Mukura seed was significantly better than that from the Katakwe, Bukalasa and Kampala seed, while that from Bulemezi seed was better than that from Bukalasa and Kampala seed.

There was a small amount of angular leaf spot present during the early stages of all the cotton, but no blackarm developed.

The cotton being late sown suffered rather badly from drought during the dry period in October and November, and very small yields were obtained.

Results.—

YIELDS OF COTTON.

		<i>Seed from</i>												
		<i>Katakwe.</i>		<i>Bulemezi.</i>		<i>Bukalasa.</i>		<i>Kampala.</i>		<i>Mukura.</i>		<i>Mean.</i>		<i>S.E.</i>
		<i>lbs.</i>		<i>lbs.</i>		<i>lbs.</i>		<i>lbs.</i>		<i>lbs.</i>				
Totals of 5 plots	...	29.5	...	36.5	...	34.7	...	32.7	...	34.8	...	32.74	...	±1.8
Means	...	5.9	...	7.3	...	6.94	...	6.54	...	6.96	...	6.548	...	±0.36
Equivalent to lbs. per acre	...	212.2	...	262.8	...	249.9	...	234.9	...	251	...	234.9	...	
Percentages	...	90.3	...	110.5	...	106.0	...	100	...	106.3	...	100	...	±5.5

Conclusions.—Weather conditions were unfavourable for the development of blackarm disease, and thus, although Bulemezi and Bukalasa seed produced significantly larger crops than either Katakwe or Mukura seed, this difference was probably due to varietal causes.

The seed from the disease free area of Mukura gave a significantly better germination than any of the others, but that from Kampala was low down in the germination counts; on the other hand the supposition that the Kampala seed came from a disease free area may be incorrect as the seed was obtained from a Kampala ginnery and the seed cotton may have been brought from elsewhere. There was a greater number of light seeds in the Bukalasa, Katakwe and Kampala samples and this was probably the cause of their poor germination.

LIME AND GREEN MANURE AND CROP RESIDUE EXPERIMENTS.

The results of these two experiments will be found in the report of the Agricultural Chemist.

FOOD CROPS.

MAIZE (ZEA MAYS): VARIETY TRIAL.

An experiment to test out three imported varieties of maize: Flat White, White Pearl and Muratha, obtained from Kenya in 1929 and grown once at Bukalasa, against locally grown Potchefstroom Pearl.

A three-acre plot was divided into five blocks of four plots each, the area of each plot being 3/20ths of an acre. Maize was planted at a spacing of 3 ft. by 2 ft. on 17th April, 1930.

The variety Flat White gave a significantly greater yield than the rest; the differences between the other three varieties were not significant.

Results.—

MAIZE YIELDS (IN THE COB).

<i>Potchefstroom</i>											
		<i>Flat White.</i>	<i>Pearl.</i>		<i>White Pearl.</i>		<i>Muratha.</i>		<i>Mean.</i>		<i>S.E.</i>
		<i>lbs.</i>	<i>lbs.</i>		<i>lbs.</i>		<i>lbs.</i>		<i>lbs.</i>		
Totals (5 plots)	...	3,802	2,852	...	2,676	...	2,139	...	2,870	...	± 374.0
Means	...	760.4	572.4	...	535.2	...	427.8	...	574	...	± 74.8
Equivalent to lbs. per acre	...	5,069	3,816	...	3,568	...	2,852	...	3,826	...	—
Percentages	...	132.5	99.6	...	93.4	...	74.5	...	100	...	± 13.0

Conclusions.—The variety Flat White, a maize very similar in habit and appearance to Potchefstroom Pearl, would appear to be an improvement on the local variety of Potchefstroom Pearl, and definitely superior, under Bukalasa conditions, to White Pearl and Muratha.

MAIZE INTERPLANTING EXPERIMENT.

The objects of this experiment are similar to those described in the cotton interplanting experiment.

An acre plot was laid out in five random blocks of four plots each, planted as follows. Each plot was 1/37 of an acre.

Maize—interplanted with beans.

Maize—interplanted with groundnuts.

Maize—mulched with elephant grass (*Pennisetum purpureum*).

Maize—clean weeded.

The beans and groundnuts were planted one month after the maize was sown; this would appear to be too late for interplanting with groundnuts, as that crop failed completely.

Results:—

WEIGHTS (IN COB).

		<i>Interplanted with beans.</i>		<i>Interplanted with groundnuts.</i>		<i>Mulched.</i>		<i>Control.</i>		<i>Means.</i>		<i>S.E.</i>
		<i>lbs.</i>		<i>lbs.</i>		<i>lbs.</i>		<i>lbs.</i>		<i>lbs.</i>		
Total (5 plots)	...	388	...	398	...	406	...	404	...	399	...	±21.20
Means	...	77.6	...	79.6	...	81.2	...	80.8	...	79.75	...	± 4.24
Equivalent to lbs. per acre	...	2,870	...	2,943	...	3,002	...	2,996	...	2,945	...	—
Percentages	...	97.6	...	99.8	...	101.5	...	101.2	...	100	...	± 5.32

The interplanted crops were unable to compete with the maize during the dry weather. There is no significant difference between the yield of maize in the different treatments.

CASSAVA (*Manihot utilissima*).

Spacing Experiment.—Native practice is to plant cassava at 6 ft. by 6 ft. or at an even wider spacing. This experiment is to determine whether larger yields are obtainable from closer spacings; at the same time the land would be better covered, and costs of weeding lessened. The following spacings were tested against the normal spacing:—

5 ft. by 5 ft.

4 ft. by 4 ft.

3 ft. by 3 ft.

A three-acre plot was divided into five random blocks of the four treatments and planted with cassava, variety "Bitamins," from 1st to 6th May.

The crop was harvested in February, 1931. The results are not significant owing to the variants due to error being greater than those due to treatments and the Standard Error has therefore not been worked out.

Results.—

WEIGHT OF CASSAVA IN LBS.

		<i>6 ft. by 6 ft.</i>		<i>5 ft. by 5 ft.</i>		<i>4 ft. by 4 ft.</i>		<i>3 ft. by 3 ft.</i>		<i>Means.</i>
		<i>lbs.</i>		<i>lbs.</i>		<i>lbs.</i>		<i>lbs.</i>		<i>lbs.</i>
Total of 5 plots	...	7,650	...	7,325	...	8,095	...	7,195	...	7,565
Means	...	1,530	...	1,465	...	1,619	...	1,439	...	1,513
Equivalent to lbs. per acre	...	9,180	...	8,790	...	9,714	...	8,634	...	9,078
Percentages	...	101.0	...	96.9	...	107.0	...	95.0	...	100

Conclusions.—The closer spacings, when once the cassava had reached the height of 4 ft., had the effect of keeping down all weeds except "Nanda" (*Commelina Africana*) which had to be dug out and carried off the plot.

PLANTAIN VARIETY TRIAL.

A plot of 1½ acres was planted in 1927 with 24 indigenous varieties of plantains, each variety repeated ten times, with the exception of the variety "Sira," of which only five root-stocks were obtainable, in a random scatter.

Some approximate idea of yielding capacity and the size of bunch of the different varieties can be obtained from the following figures of the total yields obtained in two years' cropping :—

Variety.	Number of bunches.		Total weight.		Mean weight per bunch.	
			lbs.		lbs.	
Nitaka ...	38	...	1,256	...	33.0	
Lwewunzika ...	36	...	1,061	...	29.5	
Mbwazirume ...	37	...	963	...	26.0	
Lusumba ...	35	...	895	...	25.0	
Ndybalangira ...	34	...	873	...	25.6	
Nambi ...	38	...	867	...	22.8	
Ndizabawulu ...	41	...	857	...	20.9	
Kibuzi ...	37	...	809	...	21.9	
Nakabinyi ...	32	...	779	...	24.3	
Nakyetengu ...	29	...	794	...	28.4	
Mukadealikisa ...	42	...	772	...	18.4	
Kafuba ...	30	...	758	...	25.2	
Nandigobe ...	29	...	724	...	25.0	
Nakakongo ...	30	...	713	...	23.4	
Musibampina ...	25	...	701	...	28.0	
Nasalugiri ...	26	...	659	...	25.9	
Muvubo ...	27	...	621	...	23.0	
Luwata ...	25	...	527	...	22.0	
Kyewogola ...	24	...	476	...	19.8	
Nakamali ...	25	...	474	...	18.9	
Nakitembe ...	20	...	435	...	21.7	
Namoge ...	19	...	413	...	21.7	
Buzidume ...	23	...	407	...	17.7	
Sira (5 plants) ...	17	...	476	...	28.0	

PLANTAINS: METHOD OF CULTIVATION EXPERIMENT.

An experiment designed to compare the local method of cultivation, in which all the suckers are allowed to grow, with the method of desuckering adopted in Jamaica. In the latter method only the main stem is allowed to grow until it reaches the height of 7 ft., when one sucker is allowed to grow. When the main stem has reached maturity a second sucker is allowed to develop and thus a succession of strong plants is obtained.

The experiment was commenced in April, 1927, and up to the middle of 1930 there were indications that the Jamaica method would give the higher yields. In 1929, however, the plantains were badly attacked by the banana weevil (*Cosmopolites sordidus*). The method of control, which consists in the cutting out of diseased plants, merely exercised a pruning effect on the Baganda method of planting; in the Jamaica method, however, the succession of plants was broken, and this probably accounted for the reversal of the order of yields, the difference between which, however, is not significant.

There is a significant difference between the mean weight of the bunches obtained from the two systems; those from the Jamaica system weigh nearly 7 lbs. more than those from the Baganda system.

WEIGHT PER BUNCH.

	Jamaica.		Baganda.		Mean.		S.E.
	lbs.		lbs.		lbs.		
Means ...	29.7	...	22.8	...	26.25	...	±0.73
Percentages ...	113.1	...	86.9	...	100.00	...	±2.73

Conclusions.—The results shew that a definitely bigger bunch can be obtained from plantains grown under the Jamaica method and therefore this method would probably be the better one to adopt for a commercial grower, but unless it can be proved that the yield from the Jamaica method is considerably higher than that from the Baganda method, it would seem that the Baganda method is more suitable for the native growing his own food supply, for he prefers smaller and more numerous bunches.

SWEET POTATOES.

Variety Trial.—An experiment to test the yielding capacities of the six commonest varieties of sweet potatoes grown in Bulemezi county.

The varieties grown were Buwala, Kiwoko, Nakamogoli, Magabali, Kifefe and Kawa, planted in five random blocks on 6th March, 1930, and harvested on 21st March, 1931. The size of each sub-plot was 1/40 acre.

Considerable damage was done to the potatoes by the Potato Weevil (*Alcidodes dentites*) and also by a leaf-eating caterpillar from which the variety Magabali suffered most.

Local native opinion gives the order of cropping as follows:—

Magabali	Nakamogoli
Kifefe	Kawa
Kiwoko	Buwala.

The results obtained at Bukalasa are not significant owing to the big variation in yields of the different plots of the same variety, but in three seasons at Bukalasa the variety Nakamogoli has given the greatest yield, thus it would seem that Nakamogoli is the best cropper for this area.

Results.—

YIELDS OF SWEET POTATO VARIETIES.

	<i>Nakamogoli.</i>	<i>Kawa.</i>	<i>Kiwoko.</i>	<i>Kifefe.</i>	<i>Magabali.</i>	<i>Buwala.</i>	<i>Means.</i>	<i>S. E.</i>
	<i>lbs.</i>	<i>lbs.</i>	<i>lbs.</i>	<i>lbs.</i>	<i>lbs.</i>	<i>lbs.</i>	<i>lbs.</i>	
Total (5 plots) ...	1,812 ...	1,754 ...	1,507 ...	1,108 ...	1,051 ...	930.5 ...	1,360.5 ...	±325
Means ...	362.4 ...	350.8 ...	301.4 ...	221.6 ...	210.2 ...	186.1 ...	272.1 ...	± 65
Equivalent to								
lbs. per acre ...	14,496 ...	14,032 ...	12,056 ...	8,864 ...	8,408 ...	7,444 ...	10,884	
Percentages ...	133 ...	128.9 ...	110.8 ...	81.4 ...	77.4 ...	68.8 ...	100 ...	±23.9

A palatability test was carried out on these varieties, potatoes of each variety being cooked and numbered according to the variety and tested by five natives, each of whom reported on the palatability as follows:—

The varieties are given in order of their palatability:—

1. Kiwoko	4. Buwala
2. Nakamogoli	5. Kifefe
3. Kawa	6. Magabali

The keeping qualities of the varieties follow the same order as palatability, probably owing to the least palatable varieties having the highest water content and thus the poorest keeping qualities.

Selection Work on Food Crops.—Mass selections have been made in the following crops:—Millet (*Eleusine*), beans, groundnuts, and Sunn hemp (*Crotolaria juncea*).

Single plant selections have been made in the maize variety, Flat White. Isolation plots of six maize varieties have been grown: Flat White, Potchefstroom Pearl, White Pearl, Muratha, Salisbury White, and Chester County.

Small isolation plots of the two most promising sim-sim selections were planted and sufficient seed has been obtained to plant up quarter acres next season. Both these selections have green pods containing eight loculi, as distinct from the local variety which has green pods containing four loculi.

ROBUSTA COFFEE.

Shade and Cover Crop Experiment.—An experiment was started in 1929 to test the effect of two types of shade, permanent and temporary, against no shade, the three treatments being combined with clean weeding and permanent cover cropping (*Centrosema* sp.). *Gliricidia maculata* forms the permanent shade and bananas the temporary shade, each type of shade being planted at 20 ft. by 20 ft., the coffee being planted at 10 ft. by 10 ft. square. The lay-out of the experiment is a six by six Latin square, there being thirty-six sub-plots, each 70 ft. by 100 ft.

Very satisfactory growth has been made. Owing to different habits of growth shown, all trees have been pruned so as to conform as nearly as possible to the same type, *viz.*, a multiple stemmed tree.

For the first eighteen months, cowpeas and beans were used as cover crops; when sufficiently large stocks of *Centrosema pubescens* seed were available this was substituted and from now will be the cover crop used.

During a dry spell of weather in December, 1930, most trees were attacked by mealy bug (*Pseudococcus lilacinus*) the attack being most severe on those trees under *Gliricidia* shade—the shade trees were themselves attacked by this pest. The mealy bug practically disappeared with the first rains.

DEMONSTRATION SMALL HOLDING.

The three-acre demonstration farm, laid out in 1927, has been continued. This consists of a plantain garden covering one acre, an economic crop rotation covering $1\frac{1}{2}$ acres, and a food crop rotation covering two-thirds of an acre. The holding is worked by a man and his wife; the wife cultivates the plantain garden and helps on the other plots, while the man cultivates the rest of the holding. The farm is of value in demonstrating to the native the possibility of permanent settlement on, and development of, a small holding. It is hoped to show that by adopting a suitable rotation and some simple system of manuring, that the present practice of shifting cultivation is unnecessary and uneconomic.

The rotation is the same as that detailed in the report for 1929, and it has been found that, with the rotation in force at present, the tenant has easily been able to cope with the work and make various improvements to the holding. His profits, exclusive of food consumed, for the past two seasons are as under:—

1929-30.				1930-31.			
			Shs. cts.				Shs. cts.
Sim-sim ...	...	30 lbs. @ cts. 10 per lb.	3 00	...	63 lbs. @ cts. 10 per lb.	...	6 30
Maize ...	...	2,623 „ „ cts. 02 „ „	52 46	...	{ 1,338 „ „ cts. 02 „ „	...	26 76
					{ 1,720 „ „ cts. 00 $\frac{1}{2}$ „ „	...	8 60
Groundnuts ...	...	34 „ „ cts. 05 „ „	1 70	...	345 „ „ cts. 07 $\frac{1}{2}$ „ „	...	25 87
Potatoes ...	...	1,006 „ „ cts. 02 „ „	20 12	...	1,265 „ „ cts. 02 „ „	...	25 30
Cassava ...	...	1,578 „ „ cts. 02 „ „	31 56	...	1,618 „ „ cts. 01 „ „	...	16 18
Cotton —					156 „ „ cts. 13 „ „	...	20 28
A Quality	...	478 „ „ cts. 19 „ „	90 82	...	{ 76 „ „ cts. 12 „ „	...	9 12
					{ 122 „ „ cts. 16 „ „	...	19 52
B „ ...	...	130 „ „ cts. 09 „ „	11 70	...	26 „ „ cts. 04 „ „	...	1 04
Beans ...	...	54 „ „ cts. 10 „ „	5 40	...	48 „ „ cts. 10 „ „	...	4 80
TOTAL	...	...	Shs. 216 76	TOTAL	...	Shs. 163 77	
Extra labour	...	Shs. 54/50		Extra labour	...	Nil.	
Net Profit	...	„ 162/26		Net Profit	...	Shs. 163/77.	

The net profit made in the two preceding years was Shs. 108/16 in the first year, and Shs. 149/20 in the second.

A. L. STEPHENS,
Plantation Manager.

ANNUAL REPORT OF THE COTTON BREEDING SECTION, SEASON 1930—31.

SUMMARY.

(a) **BUKALASA.**—The general weather conditions were dry, rainfall being below average, especially during the latter part of the year. Dry spells in July caused difficulties with regard to planting, and in November, December and January caused heavy boll shedding and curtailment of the flowering curve, which resulted in a rapid crop. Angular leaf spot was widespread, but weather conditions were favourable and plants were able to throw off the disease before the development of the blackarm stage.

In the breeding plot special attention was paid to resistance to angular leaf spot and to the production of an improved type of plant. One strain, B. 31, showed complete resistance to the disease while several others—among them being three families of *Acala*—showed only slight susceptibility. Several lines—among them B. 42 and B. 45—showed excellent erect habits, were storm resistant and early and quick maturers. Reselections from U. 4 were disappointing and showed no outstanding characters. Selections made from local cottons showed the greatest promise and although it will take a considerable time to fix any desirable type, improvements in both quality and yield should be obtained.

An investigation into the effect of different sized seeds from the same sample on the subsequent crop showed that although the seed weights of the two sizes differed by 100% yet no real differences in yield or quality of the subsequent crop were observed.

The shedding experiment was conducted at Bukalasa and showed total shedding of buds and bolls to be 83% of the potential crop as compared with 89% at both Kampala and Serere last season. Very few of the buds and bolls shed were shed as a direct result of insect or disease damage.

Variety Trial.—The most outstanding result of the variety trial was the failure of U. 4 to repeat its supremacy over other varieties of last season. S.G. 27, S.G. 27.15.13 and Local were all significantly higher yielders than U. 4 and definitely superior in quality. None of the Serere strains showed any superiority in yield over local cotton, but as regards uniformity of lint they are a definite improvement. S.G. 23.8 did very badly owing to its late maturing character which caused its flowering peak to coincide with the period of heavy boll shedding brought on by the dry weather. U. 4 produced a significantly higher proportion of stained and low grade cotton than any other variety in the trial except S.G. 27.15.13.

Increase plots of U. 4, S.G. 23.8 and S.G. 27.15.13 were successful and produced high yields.

Insect pests and diseases caused comparatively little damage. *Syagrus* caused a considerable loss of young plants but apart from that pest and a few aphides no damage was observed. Jassids and stainers were non-existent until the main crop had been harvested. Angular leaf spot was widespread, but practically no blackarm occurred.

Results of the first season at Bukalasa are very encouraging, several promising strains and types have been isolated, and plenty of material for selection is available in the surrounding native crop. Definite signs of deterioration in the Buganda crop are present and the improvement in quality is becoming a matter of urgency.

(b) **SERERE.**—The season was a successful one, especially when compared with last season's failure on account of blackarm. Weather conditions were generally favourable and despite rather high rates of shedding a good crop was harvested. Angular leaf spot was widespread as at Bukalasa, but here again weather conditions were such as to prevent the development and spread of the blackarm stage.

The breeding plot gave several lines showing partial resistance to angular leaf spot, among them being a useful selection, S.G. 129, which was selected for resistance in Usuku in the previous season. U. 4 selections were more promising than at Bukalasa, and it would appear that this variety is more suited to the drier areas with light soils than to the comparatively moist heavy soiled Lake basin area. Families of S.G. 23.8 and S.G. 37 (Allen) became heavily attacked by Jassids and were complete failures. Two strains from the Sudan—Delereet and Wildes No. 1—also produced no crop owing to the same pest. In the pedigree lines U. 4.4.2 did fairly well and several useful plants were selected for further trial.

A comparison of U. 4 once grown in Uganda with U.4 seed as originally obtained from Barberton showed that no deterioration has occurred as U. 4 once grown gave the higher yield, although this might quite possibly have been merely due to its better germination.

In the variety trial at Serere, as at Bukalasa, the superiority of U. 4 over our existing strains was not in evidence this season, and although no strains gave higher yields four were equal to it.

S.G. 23.8 failed badly owing to Jassids. U. 4 also produced a higher percentage of fifti cotton than most of the other strains. Examination of cotton from this trial showed very high lint indices especially when compared with those given last year, and also showed that the same varieties grown at both Bukalasa and Serere are from 1—2 mm. longer in staple when grown at the former station than at the latter.

The variety trials at the eight outside centres were disappointing as in only two of them were the results significant. The general results indicated that S.G. 27 and U. 4 were the highest yielders, while S.G. 23.8 was the lowest owing mainly to its Jassid susceptibility.

Increase.—S.G. 29 was grown for the first time in general distribution, the whole of Kadunguru gombolola being planted with it in addition to the Mulondo Seed Farm area. The Seed Farm area produced an excellent crop and the whole scheme worked very satisfactorily. S.G. 23.8 was grown as the main crop at Serere and yielded well, but owing to its Jassid susceptibility it is being discarded.

The one-quarter acre trial plots were repeated, S.G. 23.8 replacing S.G. 29, and N. 17 remaining. The total results showed no differences between the two strains but taken district by district the results gave indications of differential varietal reaction to environment.

The continuous planting experiment was repeated and again showed the value of applications of kraal manure for retaining the fertility of old plots.

Reports by brokers and spinners were received from the 1929-30 samples. S.G. 23.8 was the outstanding variety on account of its Lea strength.

GENERAL.

The establishment of two centres for cotton breeding became an accomplished fact by the opening of the new cotton laboratory at Bukalasa in July. It is intended that the new centre should serve the elephant grass zone consisting mainly of Buganda Province and Bunyoro, while Serere will continue to serve the short grass areas of the Eastern and Northern Provinces. The boundary between the two zones is approximately the River Nile. The laboratory and a house for the Cotton Botanist were completed in September, the Cotton Botanist transferring from Serere to Bukalasa in July in time to supervise the planting of the breeding plot and other cotton experiments. At Bukalasa three two-acre plots have been allocated for breeding plots and three plots of the same area for the variety trials. Each will be under cotton one year in three while for the other two years they will be under permanent cover crops so as to avoid soil erosion, and soil exhaustion by the removal of other crops. Suitable segregated plots have also been allocated for increase plots; these will be used for increase of maize and groundnuts when not required for cotton. It is hoped that the opening of a breeding centre in Buganda will result in a rapid improvement of the crop which appears to be undergoing rather steady deterioration in recent years. No work has hitherto been done on the improvement of cotton in the elephant grass areas.

STAFF.

Mr. G. W. Nye, Cotton Botanist, was at Serere until July, when he was transferred to Bukalasa. Mr. H. R. Hosking, Assistant Cotton Botanist, is stationed at Serere to carry on the breeding work in that zone. He was at Serere throughout the season until January, when he proceeded on home leave.

Mr. E. A. Ruck, Plantation Manager, carried on the work of the Assistant Cotton Botanist from January until the general work was completed at the end of March.

REPORT.

This report is divided into two sections: (a) Bukalasa, and (b) Serere.

NATIVE STAFF.

The Laboratory staffs at Bukalasa and Serere were augmented by the appointment of two Makerere trained assistants. Both of these have done much of the routine work of combing, measuring, etc., which formerly had to be done by the European staff; they have carried out their work in a thoroughly satisfactory manner and have both warranted their appointments.

BUKALASA.

METEOROLOGICAL.

Prior to planting, the rainfall was considerably below average and during July, which is normally the best planting month in this area, a prolonged dry spell of nearly three weeks was experienced which had a bad effect on early planted cotton and resulted in the main crops being planted late. Rainfall in August and September was average, but after this very little rain fell and for the last three months of the year the rainfall was five inches below the average for the last ten years. This dry weather was undoubtedly responsible for the non-appearance of blackarm except in one or two isolated cases. From November onwards hot and dry weather resulted in the rapid ripening and opening of bolls and in very heavy boll shedding. The crop was completed in a very short time and no second crop of flowers was produced. In January a considerable number of bolls ripened too rapidly, opening prematurely, with the result that a considerable amount of immature lint was produced; this was specially the case with late maturing strains such as S.G. 23.8.

The soil temperatures are interesting when compared with those of Serere as they are considerably lower and generally well within the "optimum" for development of blackarm, and yet no blackarm was in evidence.

A small hailstorm was experienced at Bukalasa in November accompanied by high wind; fortunately the breeding plot escaped the full force of this storm, but sufficient force was experienced to be useful in determining storm resistant strains, some varieties being laid almost flat, while others, e.g., B. 42 and B. 45, were unaffected.

BREEDING PLOT.

The block of land selected for breeding work was virgin soil with a distinct slope. The soil was deep and very little wash was experienced during the season. The block has been divided into three sub-blocks, only one of which will be in use in any one year, the other two will be under a permanent cover crop.

New Selection Series.—This consisted of 81 twenty-plant rows, all of which were Upland types, including fourteen lines from the original "B" series, twenty new lines which had been selected by Mr. Stephens in 1928-29 in the surrounding district, and the rest being Serere lines including ten from U. 4. The whole plot was sown on 24th July, the soil being dry and very rough. Two seeds were sown per hole where seed was available and a spacing of 5 ft. by 2 ft. was adopted. The weather was so dry after planting that hand watering was necessary on two occasions. The original stand was 86%. Resowing was done on 6th August and this gave a final stand of 94%.

Owing to the importance of blackarm disease as a limiting factor in yield in certain years, very special attention was paid to the spread of and resistance to the disease on the breeding plot. Weekly counts of leaf spot infection were made until the plants became too large to allow of accuracy. The table below gives the figures obtained from these counts. The disease varied greatly in intensity according to

variety and definite degrees of resistance were observed. For instance, three families of S.G. 99 (Allen var.) gave 100% infection within the first two weeks of the disease becoming evident, while the line B. 31 showed complete resistance throughout the season, not a single leaf spot being observed at any time. The U. 4 families showed no particular resistance. Selections from S.G. 88 (Acala) and families of S.G. 35 showed considerable resistance as well as most families of the "B" series.

TABLE I.
SHOWING SPREAD OF ANGULAR LEAF SPOT.

Date.		Number of plants infected.		Percentage of plants infected.	
September	12th	...	17	...	1.14
"	20th	...	81	...	5.45
"	26th	...	154	...	10.40
October	2nd	...	222	...	14.90
"	9th	...	315	...	21.10
"	16th	...	619	...	41.60
"	23rd	...	818	...	55.00
"	30th	...	926	...	62.50
November	6th	...	986	...	66.50
"	13th	...	1,037	...	69.50

TABLE II.
SHOWING PERCENTAGE NUMBER OF PLANTS INFECTED IN GROUPS OF THE MORE IMPORTANT FAMILIES.

		Families.							
		S.G. 85.	U. 4.	S.G. 99.	S.G. 27.	S.G. 29.	S.G. 88.	S.G. 35.	S.G. 23.8.
Number of lines :—		9. ...	11 ...	3 ...	6 ...	4 ...	3 ...	2 ...	3
Percentage number of plants infected A.L.S. on October 31st :—		68.4 ...	78.6 ...	100.0 ...	85.0 ...	90.0 ...	29.5 ...	45.0 ...	98.5

Except for a few plants in the S.G. 99 families and in U. 4 families no blackarm occurred at all.

The general habit of the crop in Buganda is very straggling—the plants have long monopodia which at the time of bolting for the most part lie on the ground and the main stems themselves are liable to lodge very easily after heavy rains and high wind. The consequence of this is that a large amount of cotton is spoiled every year by becoming mud splashed and generally soiled. Amongst the local crop are numerous promising types and several of these were included in this season's new selection series. Five lines showed great improvement in habit, namely, B. 32, B. 42, B. 45, B. 54, S.G. 88.2 and 4 and U. 4.9. These all gave erect storm resistant plants with few monopodia, which were short and erect. The details of these lines are discussed later as they have provided very useful material for work on the improvement in habit.

The flowers were counted and tied with sisal fibre daily, each flower on selfing being labelled showing the date of opening. Bolls from each plant were harvested separately and only those bolls bearing labels, *i.e.*, those which had been selfed, were harvested. Observations were made on five bolls per plant and length measurements made on ten seeds per plant, each seed from a different boll. The measuring was done by both tuft and halo methods—the former proving to be the most satisfactory one, especially as it bears a direct relation to brokers' lengths.

The most promising of the strains in this series were several of the "B's" on account of uniformity and yield. The line B. 32 produced enormous quantities of flowers, its flowering rate reaching 4.0 flowers per plant per day, but its bolls were very small and the lint short and very harsh.

B. 31 showed promise as a type resistant to blackarm. The yield was not good but the quantitative boll characters and the staple were good.

B. 42, B. 45 and B. 54 were all very similar in habit as recorded above. The first two appeared to be quick and early maturing types; their flowering curves were very steep both in the ascent and descent; additionally, B. 45 gave a lower boll shedding rate than any other line.

The U. 4 families were disappointing, most of them producing a large number of flowers but suffering badly from boll shrivelling. The staple was very short and the lint harsh. Only a few plants came up to the required lint standard and these have been selected for further trial.

The families of S.G. 27 and S.G. 29 did comparatively well and gave evidence that their lint characters are now fixed. The S.G. 23.8 group did not live up to its former promise and suffered badly from angular leaf spot.

S.G. 85 lines were very disappointing after the excellent yield given by S.G. 85 last season at Serere—nine families were grown and not one gave anything approaching the yield of the parent row and the lint characters were well below standard.

The most promising material in this series consists of the strains B. 37 to B. 57 which were selected locally—they are far from being true to type but several years' selection should enable suitable types to be evolved. Reports on the Buganda crop indicate that it is falling off in quality and it is now a matter of urgency to produce a type suitable for this part of the country with a uniform style of lint. It is possible that one of the Serere improved strains will be able to be used as a stop-gap, but a real improvement in yield and quality is not expected until selection work has proceeded at Bukalasa for a considerable period.

TABLE III.

SHOWING SOME OF THE CHARACTERS OF SOME OF THE MOST PROMISING STRAINS IN THE NEW SELECTION SERIES.

(The figures given are the means of the row in each case).

Strain.	Flowers produced.	Bolls harvested	Percentage bolls shed.	Seeds per boll.	Motes per boll.	Lint weight per boll (grms).	Lint length (mm).	Lint Index.	Ginning Outturn.	Remarks.	
B. 16	...	83	26	69	32.9	1.9	1.73	32.5	5.3	30.5	Most promising of the B. series.
B. 31	...	85	30	65	31.4	2.8	1.61	31.5	5.1	31.6	Resistant to A.L.S.
B. 37	...	103	43	58	32.9	1.9	1.79	32.2	5.4	30.4	Erect bushy type, good yielder.
B. 42	...	85	30	65	33.3	2.4	1.81	32.2	5.4	33.0	Erect quick maturing type.
B. 45	...	48	24	50	33.5	2.5	1.80	29.7	5.4	32.4	Low shedder. Erect and quick maturing type.
B. 54	...	81	34	58	31.9	1.9	1.43	31.7	4.5	28.6	Erect habit.
S. G. 88.1	...	68	26	62	33.4	2.1	1.86	32.8	5.6	31.9	Acala var.
S. G. 96.7	...	80	26	67	32.5	2.5	2.02	31.6	6.2	31.8	Reselection from S.G. 27 (S.G. 27.15.13.5.7).
U. 4.1	...	82	35	58	28.8	2.7	1.58	29.8	5.5	33.7	One of the best of the U. 4 selections.
U. 4.9	...	62	28	55	29.4	2.6	1.79	27.6	6.1	35.3	Good habit but short stapled.

Pedigree Line Series.—This is the next stage after the new selections and each line consists of two rows of twenty-five plants each. The spacing is 5 ft. by 2 ft. and on either side of each line two rows of local cotton are planted for general eye comparisons. All plants are selfed with the exception of any which may be rejected before flowering commences. Similar observations are made to those in the new selection series.

U. 4.4.2.—This was obtained from Mr. Parnell at Barberton. The plants were fairly short and erect with many sympodia. Infection by angular leaf spot was slow and only 33% of the plants were at all infected. Flowering rates were high but boll shedding was heavy and the resulting yield disappointing. The staple was very short and the lint harsh and well out of our normal class. The following were the main quantitative characters:—

<i>Seeds per boll.</i>		<i>Motes per boll.</i>		<i>Lint weight per boll grms.</i>		<i>Lint length mm.</i>		<i>Lint Index.</i>		<i>G. O. T.</i>		<i>Bolls per plant.</i>
30.2	...	2.3	...	1.79	...	27.1	...	5.92	...	36.7	...	30.2

The quality of lint is unsuitable for this country but selections of long silky linted plants were made for trial next season.

Wildes No. 1.—The seed of this was obtained from the Sudan. It suffered very badly from angular leaf spot and blackarm and hardly a sound boll was produced. A few selections were made from those plants showing any resistance to the disease.

DIAGRAM I.

FLOWERING AND BOLLING CURVES.

These curves were taken from three strains in the breeding plot and are of interest as they depict three distinct types. B. 42 and B. 45 both have very similar branching habits with practically no monopodia, this is shown up by the rapid curtailment of the flowering curves which are nearly identical in shape in each case. B. 42 is a heavy flowerer but at the same time a heavy boll shedder, while B. 45 has an abnormally small flowering curve and a low rate of boll shedding, the resulting crop being very nearly the same for both lines. The main peak of B. 45 is about a week earlier than that of B. 42 but both strains are very quick maturing. B. 37 is a heavy cropper, but while its flowering reaches the peak at the same time as the other two strains its bolling peak is three weeks later than that of B. 42 and four weeks later than B. 45. B. 37 appears to react somewhat differently to external conditions in the early stages of development as it produces practically no peak at the middle end of October, whereas both the other strains give a very pronounced one.

DIAGRAM II.

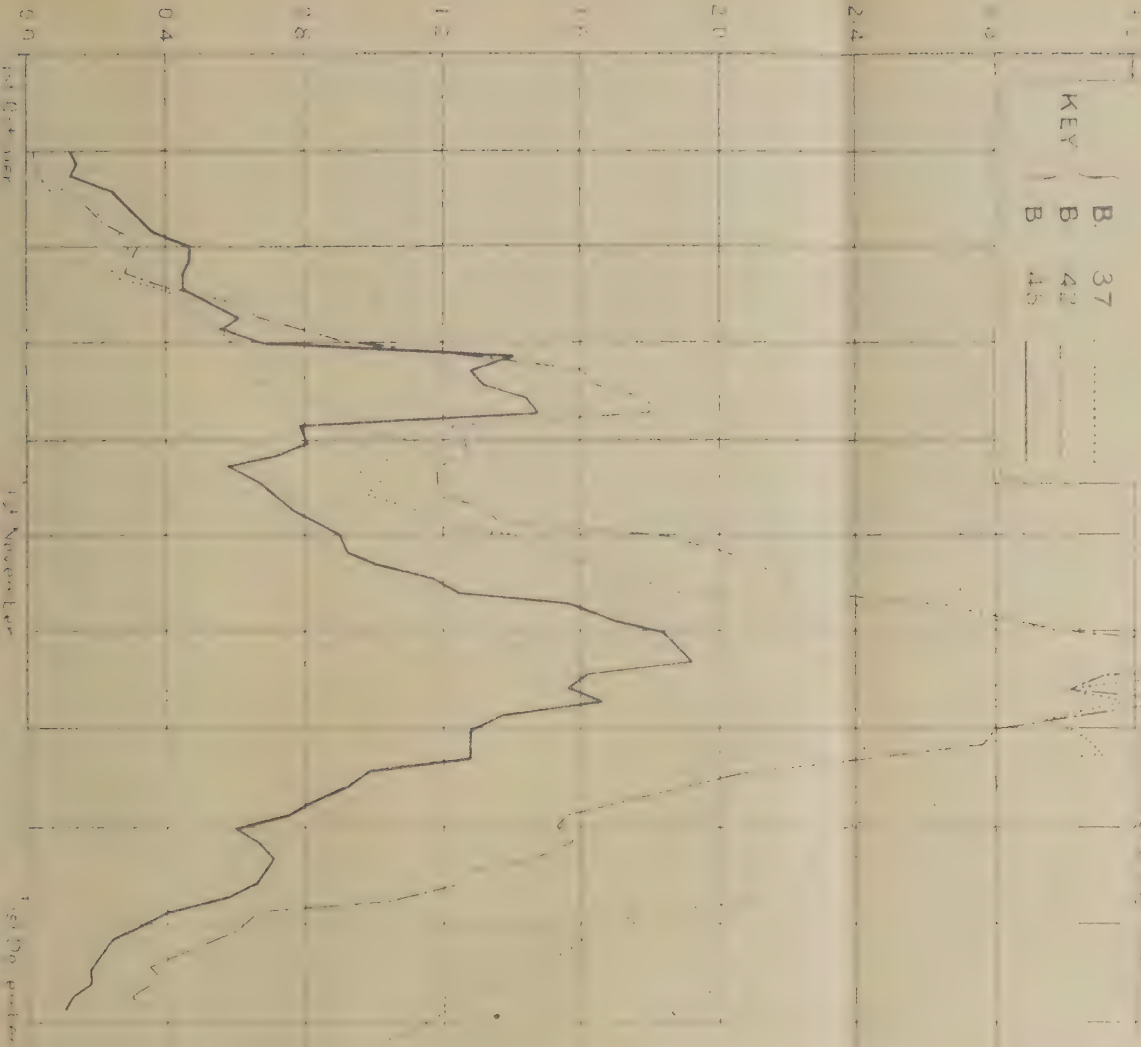
LINT LENGTH CURVES, BUKALASA.

These curves were taken from samples of the Bukalasa Variety Trial, the lengths being estimated by the "pulled tuft" method. The mixed state of Local cotton and U. 4 as compared with the two Serere strains, S.G. 27 and S.G. 27.15.13, is clearly shewn.

BUKALASA

FLOWERING CURVES

KEY
B. 37
B. 42
B. 45

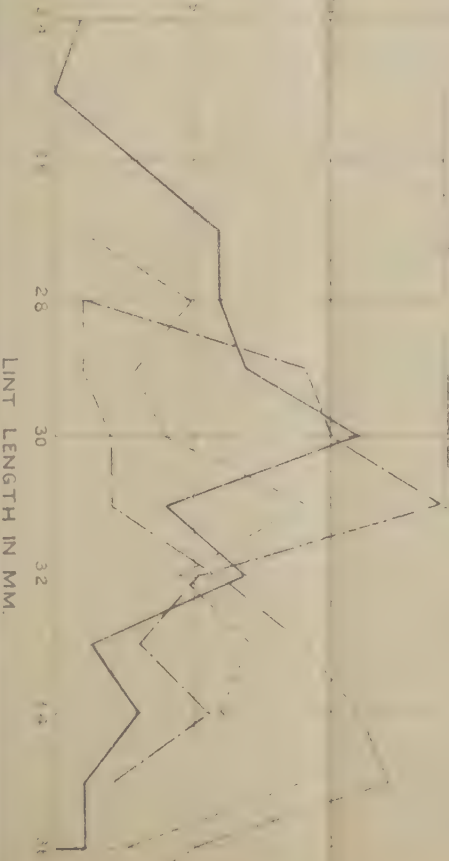


LINT LENGTH CURVES

BUKALASA VARIETY TRIAL

Estimated on F. 10 T. 1

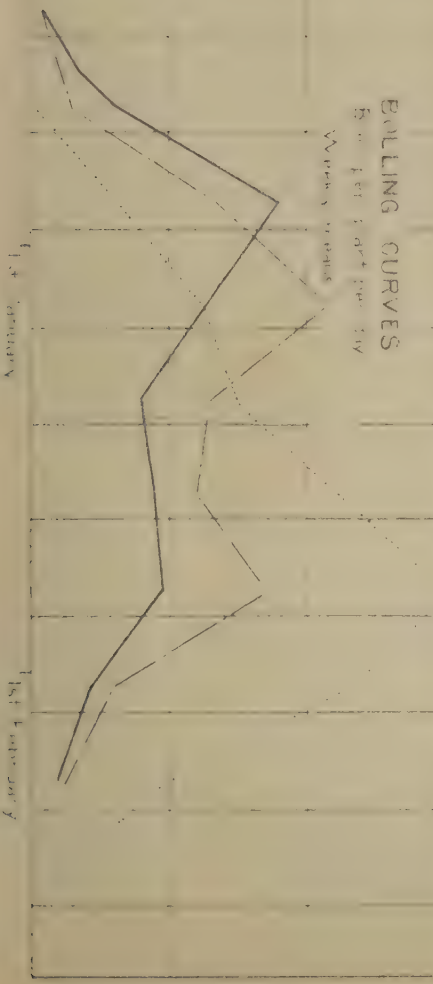
KEY
B. 37
B. 42
B. 45



BOLLING CURVES

B. 37 B. 42 B. 45

W. 1000000



FREQUENCY

(No. of Seeds Measured)

W. 1000000

Delerect.—This was also obtained from Mr. Bailey in the Sudan. The strain was badly attacked by angular leaf spot and blackarm and owing to its glabrous leaves it would probably suffer badly from Jassids (*see* Report for Serere). Bud and boll shedding were very high and a very small yield was obtained. The outstanding characters of this strain were the high weight of lint per boll and high lint index. The plants were small and their habit was not so erect as when grown in the Sudan. The following characters were recorded :—

Seeds per		Motes per		Seed weight per boll.		Lint weight per boll.		Lint length.		Lint		Ginning	
boll.		boll.		grms.		grms.		mm.		Index.		outturn.	
32.6	...	2.8	...	3.99	...	2.01	..	28.2	...	6.2	...	33.4	

S.G. 27.—This was included in the P.Ls as no increase plot was available and a supply of Bukalasa grown seed was required. It yielded comparatively well but was far from uniform. Angular leaf spot infection was heavy but little evidence of blackarm attack was observed. Several promising reselections were made:—

<i>Seeds per boll.</i>	<i>Motes per boll.</i>	<i>Seed weight per boll. grms.</i>	<i>Lint weight per boll. grms.</i>	<i>Lint length, mm.</i>	<i>Lint Index.</i>	<i>Ginning outturn.</i>
32.8 ...	2.1 ...	3.64 ...	1.69 ...	29.4 ...	5.18 ...	31.7

None of this season's pedigree lines warrant further increase except "selected S. G. 27" on account of its good showing in the variety trial. One other P.L., S.G. 96, was discarded on account of its splitting into khaki linted forms.

Reference Plot.—The following varieties were grown in small 30-plant plots for reference and selection purposes. They were all grown for the first time at Bukalasa :—

Colombia 44 (from the Sudan).—This made vigorous growth but produced short and harsh lint.

Cambodia.—Tried for Jassid resistance but not a true test as Jassids were not present in large numbers at Bukalasa this season. Angular leaf spot was severe and several plants developed blackarm.

Webber and Bancroft.—Both these produced very poor crops.

Sunflower.

Allen.—This variety did very well at Serere last season but this year it went down badly to blackarm and no plants worth selecting were observed.

Arizona.—Seed came from N. Rhodesia in 1929. Several good yielding plants were selected.

Meade, Acala, and Kasch.—None of these produced a crop worth harvesting.

G. Brasilense (*Segamwenge*).—A native cotton probably introduced into this country by traders many years ago. A typical kidney cotton, perennial, and very susceptible to angular leaf spot and blackarm.

Mixed Plot.—A 1/60th acre plot was planted with a mixture of seed consisting of all the Upland varieties and strains available. Plants were allowed to intercross freely. The F. 1 will be planted next season and again allowed to cross, after which the F. 2 will be planted and selection will commence within the mass of plants obtained.

Seed Size Investigation.—Last season where blackarm was bad in Teso and Lango a large proportion of the seed produced was very small and shrivelled. Owing to the possibility of blackarm being serious in a majority of years and to the possibility of the small seed giving rise to weakly plants a preliminary trial was laid down to test the progeny of the small seed as compared with that from normal sized seed. A sample of ordinary commercial seed was taken from Achuna ginnery and the seed was sorted out into large and small. The small seed was very shrivelled and weighed just over half the weight of the normal seed (*see* Table below). Rows of 30 plants each were sown in random pairs, there being four rows of each seed type. Weekly growth measurements were made from the time of germination—the germination of the normal seed was slightly better than that of the small seed but the latter germinated more rapidly, presumably owing to water being more easily absorbed

through their slightly fuzzed and weaker seed coat. The growth rate was about the same but the normal seed produced slightly taller plants on the average, although it was not possible to distinguish this by eye. Daily flower counts were made on each row, the balance of flowers being in favour of normal. The final yields showed no significant difference, although here again the normal seed was best. Analysis of the seed cotton showed no appreciable differences; the seed weight of the small seed reverted to the "normal" again. The lint length appear to be definitely in favour of normal seed, but the small seed produced a staple fully up to the required standard.

The results of this preliminary trial indicate that the smallness of the seed does have some very slight effect on the subsequent crop, but not enough to warrant any measures being taken to separate the small from the large seed before planting.

TABLE IV.
SUMMARISING RESULTS OF SEED SIZE INVESTIGATION.

Seed Type.	Weight 100 seeds of original sample. Grms.	Germination Percentage.		Mean Flowers per row.	Mean Yield per row in lbs.	
		Laboratory.	Field (3 seeds per hole).		Total.	Percentage Fifi.
Normal Seed ...	10.19	73%	89%	479	9.47 ...	13.6
Small Seed ...	5.68	61%	81%	405	7.61 ...	15.9

			Lint Length		Lint Index.		Seed Wt. 100 seeds in grms.	Ginning outturn.
			mm.					
Normal Seed ...	...	...	31.57	...	5.21	...	11.65	31.0
Small Seed ...	...	...	30.31	...	5.39	...	11.04	32.6

INCREASE PLOTS.

Three small bulk increase plots were grown with seed from Serere in order to provide a supply of acclimatised seed for trial under Bukalasa conditions next season.

U. 4.—A quarter-acre plot of this variety was grown and yielded at the rate of 678 lbs. per acre. The percentage fifi given on this plot was 10.8%. The type of plant was very variable and a few selections were made in the plot.

S.G. 23.8.—A half-acre plot of this strain yielded at the rate of 666 lbs. per acre with 7.8% fifi cotton. The picking peak was two weeks later than those of U.4 and S.G. 27.15.13, and the consequence of this late maturing character was to produce a large amount of immature cotton owing to the dry spell which exerted its greatest effect on the later bolls.

S.G. 27.15.13.—A quarter-acre of this strain was planted on a very poor, stony, shallow-soiled plot (the only one available) the consequence being that over 80% of the plants were very stunted and a yield of only 467 lbs. per acre was obtained.

The results from U. 4 and S.G. 27.15.13 are interesting as they clearly show that no reliance can be placed on figures obtained from single non-adjacent plots. Were the figures from these increase plots taken as being correct as far as the comparison of the two varieties is concerned U.4 would immediately be taken as being a far higher yielder than S.G. 27.15.13, but the results of the variety trial on the same farm shows that actually S.G. 27.15.13 is a significantly higher yielder than U.4.

No medium bulk or bulk plots were grown at Bukalasa this season.

VARIETY TRIAL.

The only plot available for this experiment was one which had been used for a similar purpose in the previous season and which had given an average yield of under 30 lbs. per acre. There was a fairly steep slope on the plot and a gravelly outcrop

at one top corner. The wash was rather bad after heavy rains but was checked by running the tractor and subsoiling plough along the 6 ft. alleys between the plots at right angles to the slope.

Owing to very dry weather planting was later than normal, the actual date being 31st July after rain on the previous day. At time of planting the soil was very open owing to a large amount of undecayed vegetable matter which had been dug in too late.

The lay-out was in the form of a seven by seven Latin square with the following strains under trial:—

Local cotton (consisting of a mixture of Allen, Sunflower, Black Rattler, Nyasaland and several other types).

N. 3/5.—From a selection made at Bukalasa in 1923-24 in a crop of Nyasaland Upland.

S.G. 27.—From Serere.

S.G. 29.—The Serere strain but once grown at Bukalasa.

S.G. 23.8.—The low shedding strain from Serere.

S.G. 27.15.13 from Serere.

U. 4 from seed once grown at Serere.

The plots were 34 ft. by 32 ft., giving nine rows of 18 plants each for each plot at a spacing of 4 ft. by 2 ft. The plots were separated by six-foot alleys and two rows of cotton surrounded the whole block.

Six seeds were sown per hole, but two resowings were necessary on the 12th and 27th August. In the final count both S.G. 29 and N. 3/5 gave significantly lower germinating capacity than any other strain—these were the only two strains in the trial whose seed had originated from Bukalasa and the very poor germination is accounted for by damp storage and the very poor crop of the previous season.

The final stands were as follows:—

PERCENTAGE.						
<i>Local.</i>	<i>S.G. 23.8.</i>	<i>S.G. 27.</i>	<i>S.G. 29.</i>	<i>N. 3/5.</i>	<i>U. 4.</i>	<i>S.G. 27.15.13.</i>
88.0	... 84.5	... 84.5	... 64.6	... 66.2	... 86.9	... 83.7

The plants made very slow progress and several angular leaf spot infections were observed on 17th September—at this period the plants were so under-developed that it was possible to make weekly counts of infection until the middle of October by which time nearly 80% of the plants were infected. There was no varietal difference observed either in intensity of attack or in the number of trees infected. The plots at the top end of the block showed less infection, probably due to better drainage.

At the same time the root grub *Syagrus* made its appearance and caused considerable damage, a rough count indicating that at least 4% of the crop had been killed by this pest apart from numerous plants which were attacked and damaged but which recovered later.

Up to the end of November very little varietal difference was observed except that S.G. 27 seemed to be definitely ahead of the other varieties, especially in flowering rate, while S.G. 23.8 was definitely the most backward. At this stage the development of the plants was very poor and a low yield seemed unavoidable; the root system was very poor and it was found that an impervious clay layer exists on this block about eight inches below the surface and as soon as the roots reached this they grew laterally instead of downwards.

Drier conditions in October with rain at the right time caused a great improvement in the appearance of the crop. Picking commenced on 23rd December and continued at weekly intervals until 24th February, when the crop was finished. The rapid ending of the crop was brought on by the very dry weather in January and February which caused an enormous quantity of boll shedding. The picking curves of all varieties were very similar except in the case of S.G. 23.8, whose picking peak was a fortnight later than that of an other variety.

The following table summarises the results :—

TABLE V.

Variety.	Mean Yield per plot in lbs. (1/40th acre.)	Yield expressed as percentage of mean.	Percentage Fifi (stained and low grade cotton).
S.G. 23.8	15.54	96	9.1
S.G. 27	18.49	114	10.5
U. 4	14.36	89	12.6
N. 3/5	15.09	93	10.9
S.G. 27.15.13	17.27	106	11.6
S.G. 29	14.09	87	11.1
Local	19.02	118	9.1
MEAN	16.20	100	10.7
S.E. of the difference	1.45	8.9	0.74

Taking the figures for "Total" cotton, *i.e.*, those given in the first column of the table, Fisher's "Z" test showed the experiment to be significant with the following results :—

No differences between Local, S.G. 27 and S.G. 27.15.13.

Local and S.G. 27 both gave significantly higher yields than U. 4, S.G. 23.8, N. 3/5 and S.G. 29.

S.G. 27.15.13 gave a significantly higher yield than S.G. 29 and U. 4.

No differences between the others.

The poor showing of N. 3/5 and S.G. 29 was undoubtedly due to the very poor stand given by both these strains. The most outstanding result is the significance of Local and S.G. 27 over U. 4, which was totally unexpected after the very pronounced superiority of U. 4 at Serere in the previous season. The late maturing character of S.G. 23.8 was a definite hindrance to it this season when the dry weather caused heavy shedding of the later formed bolls. The flower-curve of this strain indicated at first that it would out-yield all the other strains, but its low boll shedding character was upset by the drought.

The figures in column 3 of Table V represent the percentages of "fifi" cotton. The Analysis of Variance worked out on these figures showed them to be significant with the following results :—

U. 4 gave a significantly higher percentage of fifi cotton than any other strain except S.G. 27.15.13.

S.G. 29 and S.G. 27.15.13 gave a significantly higher percentage of fifi than either Local or S.G. 23.8.

The proportion of low-grade cotton is very low and this must be ascribed to the absence of stainers throughout the season. The high proportion of low grade cotton in U. 4 as compared with the other strains was not unexpected as the number of shrivelled and diseased locks always appeared to be much greater than in the other strains.

Samples of seed cotton from each strain in the trial were examined in the laboratory and the results are summarised in the table below :—

TABLE VI.

Variety.	Lint Length (mm.)	Lint Index.	Weight 100 Seeds (in grms.)	Ginning Outturn.	Grader's order of merit.
S.G. 23.8	31.2	5.6	10.8	34.1	6
S.G. 27	31.1	5.6	12.5	30.9	1
S.G. 29	32.1	5.9	12.4	32.2	2
S.G. 27.15.13	33.4	5.7	13.7	29.4	3
U. 4	29.7	5.5	10.9	33.5	7
N. 3/5	31.4	5.4	12.1	30.7	4
Local	32.0	5.2	11.9	30.4	5

U. 4 and S.G. 23.8 are definitely small-seeded types and for this reason both give high ginning outturns. U. 4 produces lint definitely shorter and harsher than our normal cottons and belongs to quite a different class, while S.G. 27.15.13 is almost approaching the "too long" type of cotton.

Shedding Experiment.—This experiment was conducted at Bukalasa on exactly similar lines to those at Serere in the previous season, collection of shed material being made twice daily. The shed buds and bolls were collected off strips of mosquito gauze wire laid along the two rows under observation. In addition to collection and classification of shed material, flower counts were made daily and bolls picked and counted at five-day intervals. The buds and bolls shed were classified according to width across the bracts in the case of the buds and according to the widest diameter in the case of the bolls; classification was also done with reference to cause of shedding when possible. It was found almost impossible to be certain whether the smaller buds and bolls were shed through physiological or other causes and when any doubt arose they were all put under the heading "physiological." The freedom from insect pests at Bukalasa is clearly shown by the very few buds and bolls classified as showing insect damage; the number of diseased bolls is also practically negligible, but here again it is difficult to ascertain whether small buds and bolls are diseased or not.

This season there was again high correlation between the rainfall peaks and the peaks of bud shedding, which were very high. The boll shedding was mainly due to drought conditions which were experienced from December onwards and which completely curtailed the flowering curves by the middle of January so that no second crop whatsoever was produced.

The summary of the results obtained is given in the table below:—

TABLE VII.

NUMBER OF BUDS SHED PER PLANT CLASSIFIED ACCORDING TO WIDTH ACROSS THE BRACTS (IN MM.).

(a) *Physiological.*—

	2—5 mm.	5—8 mm.	8—12 mm.	12—16 mm.	16—24 mm.	24 mm. and over.	Total.
Total per plant...	85.5	9.9	8.8	7.5	2.9	Nil	114.6
Percentage	74.6	8.6	7.7	6.6	2.6	Nil	

(b) *Insect Damage.*—

Total per plant...	Nil	Nil	1.2	1.7	1.7	0.1	4.7
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NUMBER OF BOLLS SHED PER PLANT CLASSIFIED ACCORDING TO DIAMETER OF BOLL.

	5—8 mm.	8—12 mm.	12—16 mm.	16—24 mm.	Over 24 mm.	Total.
Total per plant	24.6	8.6	2.7	0.6	0.06	36.7
Percentage	67.0	23.4	7.6	0.5	0.2	

TABLE VIII.

SHOWING TOTALS SHED PER PLANT AND TOTALS PRODUCED.

Total Buds shed.	Total Flowers produced.	Total Bolls shed.	Total Bolls harvested.
125	75	42	33

The potential crop was therefore 125 plus 75—200 bolls, and the actual crop produced was only 16.4% of the potential, showing a loss through shedding of 83.6% of the possible crop. This is divided into 62.5% due to bud shedding and 21.1% due to boll shedding. Of these totals only 0.54% of the buds shed and 2.4% of the bolls shed could be definitely ascribed to insect pests. The percentage bolls shed to flowers produced was 56.0%. The total loss of 83.6% compares with the 89% observed last season at both Serere and Kampala. These figures are suggestive of the possibility that under conditions in this country not more than 20% of the buds produced will develop into bolls harvestable, no matter what the conditions. It is certain that the cotton plant could not produce a crop from every bud. Isolated plants do undoubtedly produce 200 bolls, but then their budding and flowering is correspondingly higher. A crop of three sound bolls per plant will give 100 lbs. per acre, so that 200 bolls per plant is equivalent to nearly 7,000 lbs. per acre.

INSECT PESTS AND DISEASES.

Owing to the dry conditions very little damage of any sort was done to the crop by either insects or diseases except for attacks on the young plants by *Syagrus*. The details are given below :—

Syagrus sp.—This pest caused considerable damage to plants in the early stages although the attacks were by no means confined to the young plants. A direct loss of 4% of the plants in the variety trial was ascribed to *Syagrus*. Quite a number of plants (not included in the estimated loss above) were attacked but recovered later and were able to yield a crop of sorts. The pest only appeared on old plots.

Lygus.—This undoubtedly caused quite a lot of damage on the variety trial but it is unlikely that it had much effect on the final yield.

Aphis caused some damage to plants in the breeding plot and variety trial, several plants being permanently stunted as a result. Not 1% of the crop was in any way affected by *aphis* damage.

Jassids.—These were practically non-existent until after most of the crop had been harvested; they appeared then, but too late to do any damage.

Earias insulana.—This was responsible for very little damage at Bukalasa, very few apical buds were damaged, and shed material collected from the shedding experiment showed very few cases of spiny bollworm attack.

Dysdercus spp.—Only a single stainer of this genus was observed throughout the season until the plants were uprooted, the result being a very small percentage of stained cotton. The average “fifi” cotton picked from the experimental plots was under 10%, which is equivalent to about 5% commercially, as very careful picking over of all experimental cotton is done as soon as it is harvested. This total of 10% compares with a figure of about 25% at Serere from the same experiments, same varieties and same careful picking over.

DISEASES.

Angular Leaf Spot.—This disease appeared in August about three weeks after planting and spread rapidly until about 80% of the crop was affected. Very little damage was done except for a few leaves being shed. In very few cases were bolls observed to be infected with the “spot” stage. The amount of blackarm which developed was negligible, only a few isolated plants being attacked.

Ramularia.—Plants in the breeding plot became quite heavily infected with this disease and a considerable number of leaves were shed, one or two strains, U. 4.29 in particular, appeared to be more susceptible than others.

Boll Rots.—The absence of stainers meant the comparative absence of boll rots. Very few bolls were observed suffering from these diseases.

NOTES ON BUGANDA PROVINCE AND EASTERN PROVINCE CROPS.

Owing to pressure of work at Bukalasa no tour of the cotton areas of Buganda was possible with the exception of the Bulemezi County, which provided a useful field for selection purposes. The crop in this county was unfortunately planted late and although the flowering rate reached a very high peak and gave promise of a really good crop, the very dry weather experienced in the latter part of the year caused such high boll shedding that a comparatively small crop was reaped. The earlier planted cotton again gave the best yields, some of the late August and early September sown plots hardly producing a crop at all. Angular leaf spot was fairly general, but practically no blackarm was observed. Samples were obtained from Bulemezi and Mawokota Counties and examination of these showed that the staple was considerably shorter than in the last two seasons and that the lint was decidedly rough and weak. There appears to be no lack of evidence that the Buganda crop is undergoing a steady process of deterioration in quality which is really only to be expected when it is considered that no complete change of seed has been made since the original introduction of Upland cotton. Sunflower was introduced in 1916 but the existing cottons were not entirely destroyed with the consequence that the present crop consists of an enormous mixture of types.

Samples were received from various ginneries in the Eastern Province as well as from the quarter-acre trial plots but unfortunately they arrived too late to be dealt with fully in this report. The general crop in this Province showed an immense improvement in quality over that of the previous season, when blackarm was so widespread. The proportion of immature cotton was considerably less this year and the lint index is nearly double and in some cases considerably higher than normal. The staple of the crop was good as a whole but it shortened off rather towards the end of the season.

SERERE.

BREEDING PLOT.—The first of the three new breeding plots was used this season. The soil appeared to be fairly good and deep and there was little wash. The plot was divided up into three sections—(a) New Selection Series, (b) Pedigree Line Series, and (c) Comparison of U. 4 once grown with the original seed.

(a) *New Selection Series.*—Seventy-six strains were grown, the spacing, etc., being similar to that used at Bukalasa. The whole series was planted on 12th July, each hole being hand-watered at the time of sowing. The following groups of families were included—18 selections from U. 4, nine from S.G. 23.8, six from S.G. 85, and five from S.G. 29. As at Bukalasa, careful observations were made throughout the season with regard to blackarm disease. The angular leaf spot form appeared early in September and after a check in the middle of the month it spread rapidly, until on October 1st at least 95% of the plants in the plot were infected. Considerable variation in degree of attack was observed. S.G. 129 (a selection made from a native plot near Nariama) was the most resistant line, while U. 4.5, S.G. 93A (a reselection from S.G. 35) and the S.G. 88 families (*Acala var.*) were comparatively resistant. Practically no blackarm occurred in the plot.

Few strains were outstanding from the yield point of view, the S.G. 85 families being very disappointing, as at Bukalasa. The most promising material in the series were selections made in S.G. 88, S.G. 129, and U. 4 families, and also families of S.G. 35 which have now reached commercial purity.

The following table gives a summary of the quantitative characters of the most important reselections made amongst the New Selections Series :—

TABLE IX.

<i>Plant No.</i>	<i>Seeds per boll.</i>	<i>Motes per boll.</i>	<i>Lint weight, per boll in grms.</i>	<i>Lint Index.</i>	<i>Lint Length (mm).</i>	<i>Ginning Outturn.</i>	<i>Number of bolls produced.</i>
S.G. 129.2	... 35.0	... 1.0	... 2.00	... 5.7	... 29.2	... 34.4	... 77
S.G. 129.4	... 34.0	... 1.0	... 1.94	... 5.7	... 30.1	... 29.3	... 32
S.G. 129.9	... 36.0	... 2.5	... 2.65	... 7.4	... 29.3	... 39.0	... 36
S.G. 88.1.2	... 39.5	... 2.0	... 2.69	... 6.8	... 30.7	... 35.9	... —
S.G. 88.1.7	... 42.0	... 2.0	... 2.44	... 5.8	... 31.0	... 37.0	... 31
S.G. 88.1.13	... 32.5	... 2.5	... 2.14	... 6.6	... 29.0	... 35.8	... 38
U. 4.1.2	... 36.0	... 1.5	... 2.55	... 7.1	... 30.8	... 38.6	... 45
U. 4.1.12	... 34.0	... 0.0	... 2.10	... 6.2	... 31.8	... 37.4	... 23
U. 4.30.15	... 34.8	... 1.5	... 2.61	... 7.5	... 30.8	... 37.6	... 25

It is noteworthy that the U. 4 families did very much better at Serere than at Bukalasa—at Bukalasa very few plants produced lint with 30 mm., whereas at Serere quite a large number reached that length. The drier conditions of the Eastern Province would appear to be more suitable for U. 4 than the comparatively moist Lake basin area. The lint weights and lint index figures are high this season, nearly twice those obtained last year. It is remarkable that, *e.g.*, at Bukalasa where conditions are more favourable for cotton a much lower lint index was obtained, but as a general rule (U. 4 excepted) the staple is from 1 to 2 mm. longer at Bukalasa than at Serere for the same cottons.

(b) *Pedigree Line Series.*—As at Bukalasa, each line consisted of two rows of 25 plants each with a row of S.G. 29 cotton on either side for eye comparisons.

U. 4.4.2.—This strain was obtained from Barberton and showed considerable resistance to angular leaf spot. Considerable variation in lint length occurred and only one or two plants produced staples of 30 mm. Several selections were made in this line.

Delerect.—This was similar seed to that grown at Bukalasa. It was a complete failure owing to its susceptibility to Jassid attacks.

S.G. 35.10.14.1.2. and S.G. 35.10.14.8.1.—These two lines were practically identical in all characters. Both showed comparative resistance to Jassid and angular leaf spot and they both yielded well. S.G. 35.10.14.8.1 was definitely more resistant to angular leaf spot than the other but was shorter stapled. One of the strains will be bulked for increase next season.

S.G. 27.15.13.5.7 was one of the best of this series. It is very true to type and has been bulked for next season's variety trial.

Three families of S.G. 37.1.3.14. (originally selected from Allen) were grown. All of these went down very badly to Jassids, angular leaf spot and some blackarm. They have all been discarded.

Three families of S.G. 23.8.6.13 selected on account of their low shedding habit were so badly attacked by Jassids that they produced practically no crop at all. They have also been discarded.

(c) *Comparison of U. 4 once grown at Serere with U. 4 as originally obtained from Barberton.*—The object of this small experiment was to determine whether acclimatisation had had any effect on U. 4 and whether the seed had become infected with blackarm after being subject to the disease in the previous season. Fifteen thirty-plant rows were grown from each seed type, the rows being in random pairs. Germination was higher for the once grown than for the original seed, the figures being 81% for the original against 90%; this, however, was to be expected, as the original seed was three years old and was certain to have lost viability. The percentage attacked by angular leaf spot was 60% in the original and 76% in the once grown. This was not a significant difference but did give some indication of increase in infection or susceptibility through being grown at Serere. These figures were taken in September and by the end of October the differences had evened up. Each row was harvested separately and the final yields were as follows:—

Variety.	Mean Yield per Row (lbs).				S. E. Difference.
U. 4 (Original)	...	...	2.81	...	—
U. 4 (Once grown)	...	...	3.22	...	0.15

The results satisfied Fisher's "Z" test and thus U. 4 once grown shows a significant increase in yield over the original. This increase may have been in part due to better germination but it definitely shows that no deterioration with regard to yield has occurred by growing U. 4 once at Serere.

INCREASE PLOTS.

(a) *Small Bulk.*—Three such plots were grown at Serere: S.G. 27.15.13, S.G. 96 and N. 3/5 from Bukalasa. S.G. 27.15.13 yielded at the rate of over 1,200 lbs. per acre after a poor stand and some blackarm. The plot of N. 3/5 was planted in connection with the interchange of seed experiment—it yielded at the same rate as S.G. 27.15.13. The strain S.G. 96 produced evidence of vitiation and has as a consequence been scrapped.

(b) *Medium Bulk.*—A two-acre plot was planted with U. 4 for seed supply purposes and yielded at the rate of 930 lbs. per acre. The germination of the first planting (in July) was only 30% but after resowing a good stand was obtained. Owing to the comparatively poor quality of this variety and to the fact that it showed no signs of last season's superiority in yield over our existing strains it is not intended to proceed any further with multiplication of it, but it is hoped that by selection a strain with an improved quality may be obtained.

(c) *Bulk Increase.*—The 30 acres on the main farm at Serere were planted with S.G. 23.8, this strain having shown promise in yield trials in the year before and having had such excellent reports on its lint. Although this strain was badly attacked by Jassid in all the variety trials including the one at Serere, yet on the main farm practically no damage was observed and a yield at the rate of 550 lbs. per acre was obtained. This Jassid susceptibility has made it unwise to proceed further with the multiplication of this strain.

(d) *Seed Farm Area, Mulondo*.—This area was again planted up with S.G. 29, the seed being obtained from the previous year's crop at Mulondo. Great efforts were made to obtain an increased acreage and finally 402 acres were planted as compared with 280 in the previous year. Unfortunately most of this cotton was planted in July and August and suffered badly from drought. The final yield was at the rate of 500 lbs. per acre which was very satisfactory, although it is not the maximum for this area as June-sown cotton is generally the highest yielding. The whole scheme worked very satisfactorily, the buying and ginning being again undertaken by Messrs. Foster Brothers.

(e) *Limited Distribution, Kadunguru Gombolola*.—The first commercial distribution of S.G. 29 was done this season, Kadunguru Gombolola being chosen as being the most likely place for keeping the strain free from mixing. The seed was obtained from the Mulondo crop of the year before; the yield was very satisfactory and the quality appeared to be a distinct improvement on the local type.

S.G. 29 was not included in the one-quarter acre trial plots this season, being replaced by S.G. 23.8, but comparisons with N. 17 (Local) are possible at the nine variety trial centres—at six out of the nine S.G. 29 gives a higher yield than N. 17, at one there is practically no difference, and at two N. 17 gives a higher yield than S.G. 29. In general quality and uniformity S.G. 29 is a distinct improvement on N. 17 at all centres.

Brokers' and spinners' reports were received on samples from some of the one-quarter acre trial plots of N. 17 and S.G. 29 of the previous season. It was hoped that the results of these tests would make it possible to form rough quality maps of the Eastern Province which would be valuable in the estimation of the locality effects on variety. Unfortunately, too few samples could be reported on—only 25 pairs for brokers' reports and nine pairs for spinning tests—to make any true differentiation into quality areas possible. In addition the "quality" according to the brokers was in several cases opposite to the "quality" according to the spinning test results, with the consequence that a map plotted for broker's good quality showed a tendency to become a map of poorer spinning qualities. The general results showed a balance in value of crop per acre in favour of S.G. 29 for all districts except Bugwere. The spinning report stated that the locality effect was more pronounced than the variety effect except at Buluya, where S.G. 29 is definitely superior to N. 17, and at Ngetta, where the reverse is the case. The samples from Gogonyo and Awelo gave the best results, while those from Buyende were definitely the worst. It will be noticed in the table below that the broker valued N. 17 at Buyende considerably higher than any other of the samples under consideration, whereas as mentioned above it produced the worst yarn of all. The staple appears to bear little relation to the strength and appearance of the yarn as the Gogonyo samples which produced the shortest staple were cited as producing the best yarns.

TABLE X.
SUMMARISING BROKER'S AND SPINNING REPORTS ON SAMPLES FROM THE ONE-QUARTER
ACRE TRIAL PLOTS OF S.G. 29 AND N. 17, 1929-30 SEASON.

Centre.	Lea Strength		Strength x Count		Broker's Valuation in pence per lb.		Broker's staple		Staple by pulled tuft.		Yield in Lbs. per quarter-acre.	
	N. 17.	S.G. 29	N. 17	S.G. 29	No. 17	S.G. 29	N. 17	S.G. 29	N. 17 mm	S.G. 29 mm	N. 17	S.G. 29
BUSOGA :—												
Buluya ...	52'6	56'6	2,078	2,298	7'85	7'40	1'3/16	Full 1'1/8	31'1	30'1	236	354
Vukula ...	53'9	52'6	2,210	2,157	7'85	7'30	1'1/8—	Full 1'1/8	30'4	32'4	132	122
Buyende ...	49'0	49'1	1,960	1,944	8'60	7'40	1'3/16	Full 1'1/8	31'0	31'6	109	93
BUGWERE :—												
Gogonyo ...	54'2	56'1	2,195	2,250	7'45	7'10	Full 1'1/8	Full 1'1/8	29'0	28'0	105	74
BUDAMA :—												
Musafu ...	52'5	54'9	2,132	2,158	7'35	7'45	Full 1'1/8	1'1/8— 1'3/16	28'1	29'5	34	39
LANGO :—												
Awelo ...	57'5	56'4	2,288	2,262	7'10	7'30	1'1/8th	" "	29'8	30'1	97	151
Ngetta ...	56'3	52'0	2,224	2,038	6'85	7'10	1'1/8th	" "	29'4	30'1	46	45
TESO :—												
Serere ...	53'6	53'8	2,219	2,125	7'60	7'30	1'1/8th	1'1/8	29'5	30'8	71	66
Labori ...	56'3	56'8	2,241	2,232	7'10	7'85	1'1/8th	1'1/8— 1'3/16	30'4	31'2	83	71

The above samples were spun to 40's (Twist Ring).

NOTE :—"Count" = the number of hanks of yarn, 840 yards long, to the pound.

"Lint Index" = the weight of lint in grams obtained from 100 seeds.

"Notes" = undeveloped seeds.

VARIETY TRIAL, SERERE.

The plot chosen for the variety trial at Serere was the most even piece of land in the newly opened block, the position, size, shape and number of plots being determined from the results obtained from the Uniformity Trial of the previous year.

The land was planted with Bulo (*Eleusine*) which was ploughed in some time prior to planting. The lay-out adopted was in the form of random blocks, there being 12 blocks of eight plots each. Each plot was 27 ft. by 27 ft. (approx. 1/60th acre) with a spacing of 3 ft. by 1 ft. and six seeds sown per hole.

The following varieties were under test—N. 17 (Local), N. 17 (Busoga); these two were included in this and three outside trials in order to find out if the introduction of seed from the blackarm-free areas in Busoga had any affect on the yield of the crop, S.G. 27, S.G. 29, S.G. 23.8, S.G. 27.15.13, S.G. 96 and U. 4. These are all derivatives from Nyasaland Upland type except U. 4, which appears to have been derived from Sunflower.

The plots were planted on 25th July, later than usual owing to a prolonged dry spell in the middle of July. Germination was rapid and the original stand gave a mean of 81% which was raised to 90% after the first resowing. There were considerable differences in the germination capacity of the various varieties which were shown as being significant by Fisher's Analysis of Variance. The results are tabulated below:—

PERCENTAGE STAND.													
Varieties.													
N. 17 (Local).	N. 17 (Busoga).	S.G. 23.8.	S.G. 27.	S.G. 29.	S.G. 27.15.13.	U. 4.	S.G. 96.						
65	... 72	... 92	... 91	... 85	... 75	... 93	... 77						

The S.E. of Comparison=2.6.

The results were:—

No difference between S.G. 27, S.G. 23.8 and U. 4.

S.G. 27, S.G. 23.8 and U. 4 gave significantly better stands than S.G. 29, S.G. 96, S.G. 27.15.13 and both N. 17. varieties.

S.G. 29 significantly better than S.G. 27.15.13 and both N. 17s.

S.G. 96 significantly better than both N. 17s.

S.G. 27.15.13 significantly better than N. 17 (Local).

Indications that N. 17 (Busoga) is better than N. 17 (Local).

Angular leaf spot appeared early in October and 90% infection occurred in a few days. There was, however, practically no sign of blackarm at any time and the plants recovered from the leaf spot attacks.

Picking commenced on 1st December and continued at weekly intervals until 16th February.

The most noteworthy feature of this trial was the breaking down of the hitherto promising strain S.G. 23.8 under Jassid attacks. In January the plots of this strain could be picked out from a considerable distance owing to the reddening of the leaves and stunting of the plants. No other strain appeared to suffer much damage from this pest and it is very useful to have evidence of the Jassid susceptibility of S.G. 23.8 before further increase has taken place.

In picking, first and second quality cottons were carefully separated and the results have been worked out (a) on total yields, and (b) on percentage of stained and low quality cotton.

The results from the "Total seed cotton" are as follows:—

TABLE XI.
MEAN YIELD PER PLOT IN LBS.

Varieties.											
S.G. 27.	U. 4.	S.G. 96.	S.G. 27.15.13.	S.G. 29.	N. 17 (Busoga).	N. 17 (Local).	S.G. 23.8.	M.	S.E.	Diff.	
11.9	... 11.8	... 11.7	... 11.4	... 11.3	... 10.6	... 9.7	... 8.6	... 10.9	... 0.62		
YIELDS AS PERCENTAGE OF THE MEAN.											
Varieties.											

YIELDS AS PERCENTAGE OF THE MEAN.

Varieties.																					
S.G. 27.	U. 4.	S.G. 96.	S.G. 27.15.13.	S.G. 29.	N. 17 (Busoga).	N. 17 (Local).	S.G. 23.8.	M.	S.E.	Diff.											
109	...	108	...	107	...	104	...	104	...	97	...	89	...	79	...	100	...	5.7			

There was no significant difference between S.G. 27, U. 4, S.G. 96, S.G. 27.15.13, and S.G. 29.

U. 4, S.G. 27 and S.G. 96 gave significantly higher yields than both types of N. 17 and S.G. 23.8. S.G. 29 and S.G. 27.15.13 gave significant yields over Local N. 17.

All strains were significant over S.G. 23.8.

These results when compared with those of the Serere variety trial last year are remarkable. U. 4 instead of giving twice the yield of any other variety is bracketed with four others. It does not appear that U. 4 is resistant to blackarm as it was badly affected with angular leaf spot this season, but its superiority last season was probably due to its comparative freedom from seed infection. This year the balance had evened up and conditions were against the development of the disease. Again, last year the strain S.G. 23.8 came next to U. 4 in order of yield, while this year it is a bad last owing to Jassid which were not present in large quantities last year.

The results worked out on percentage of "fifi" are given below; the percentage is higher all the way through than it would be commercially as all pickings were very carefully picked over.

TABLE XII.

PERCENTAGE FIFI.

Varieties.

U. 4.	S.G. 96.	S.G. 23.8.	N. 17 (Busoga).	N. 17 (Local).	S.G. 29.	S.G. 27.	S.G. 27.15.13.	M.	S.E. Diff.
30.6	28.3	27.4	27.3	27.2	26.0	25.0	24.8	26.9	1.67

U. 4 gave a significantly higher percentage of "fifi" cotton than S.G. 27, S.G. 29, S.G. 27.15.13, and both types of N. 17.

S.G. 96 gave a higher percentage than S.G. 27 and S.G. 27.15.13.

These results are interesting to compare with those from Bukalasa:—U. 4 gives a higher percentage of low grade cotton at both places but the order of the other varieties is different and S.G. 27.15.13 gives proportionally a higher percentage of fifi at Bukalasa than at Serere, while with S.G. 23.8 the case is reversed.

The examination of seed cotton samples from these varieties gave the following figures:—

TABLE XIII.

Variety.	Lint Length. mm.	Lint Index.	Seed Weight. Grms. per 100 seeds.	Ginning Outturn.
S.G. 27	30.3	6.13	13.4	31.4
U. 4	28.1	6.40	10.1	38.7
S.G. 27.15.13	30.5	7.54	14.6	34.1
S.G. 29	31.3	6.28	14.3	30.5
N. 17 (Busoga)	28.9	6.20	12.5	33.1
N. 17 (Local)	30.2	6.44	12.7	33.8
S.G. 23.8	29.7	6.00	11.1	35.1

The noteworthy feature of the above table is the very high lint index, especially when compared with that of last year, which was very little more than half the above figures. Both lint indices and seed weights are higher than those given at Bukalasa in practically every strain, while the lint lengths are shorter in every case. The difference in lint length between N. 17 (Busoga) and N. 17 (Local) is very striking, and is probably due to the less pure state of the Busoga N. 17.

OUTSIDE VARIETY TRIALS.

Variety trials were conducted at the following centres in the Eastern Province, each centre being selected as being representative of definite soil and climatic area.

Labori	...	Teso District.
Orungu	...	" "
Ngora	...	" "
Kamuge	...	Bugwere District.
Vukula	..	Busoga District.
Ngetta	...	Lango District.
Aduku	...	" "
Kaberaimaido	...	" "

The following varieties were grown at each centre:—S.G. 27, S.G. 29, S.G. 23.8, U. 4 and N. 17 (Local), while at Labori, Ngetta, and Ngora N. 17 (Busoga) was also included.

The lay-out and arrangements of the plots were different at the various centres, the former to fall in with the need for true randomisation at the expense of convenience and the latter owing to the difficulty in obtaining convenient plots in every instance. The size of plot was 1/40th acre at every centre.

A trained native observer was stationed at all centres and he was responsible for rainfall records, flower counts and general supervision of the plots.

Labori.—The site of the experiment was on the same plot as the previous season. A crop of *Eleusine* was sown after last season's crop was taken off and this was ploughed in as a green manure on 21st May. General observations made in this fruitful area showed that in most years early planting was advisable and this experiment was accordingly planted on 5th June. Much of the "bulo" was unrotted and had to be carried off before planting was possible. Spacing was 3 ft. by 1 ft. with six seeds per hole. Excellent conditions followed planting and a good stand was obtained. The resultant crop yielded at the amazing rate of over 2,000 lbs. per acre, which demonstrates what our cottons are capable of, given optimum conditions.

The very excellent conditions completely masked the slight differences in yield which have been given at other centres by various of the varieties under test.

The following table gives the yields per plot:—

TABLE XIV.
MEAN YIELD PER 1/40TH ACRE PLOT IN LBS.

Varieties.											
S.G. 27.		S.G. 29.		S.G. 23.8.		U. 4.		N. 17 (Local).		N. 17 (Busoga).	Mean.
55.5	...	54.0	...	53.0	...	54.9	...	55.5	...	54.9	54.4

Ngora.—The lay-out here was in the form of six random blocks—Nos. 1, 2 and 3 being situated on a plot which had been under cotton the previous season, while the other three blocks formed an extension of this plot which had not been under cultivation for some time. Planting was done on 19th June with the same spacing and seed rate as at Labori. The crop as a whole did well, but S.G. 23.8 suffered badly from Jassid and is again last in order of yield. The results from this trial showed no significance by Fisher's "Z" test but the mean yields are given for interest as they follow closely the order given at Serere.

TABLE XV.
YIELDS IN LBS. PER 1/40TH ACRE.

Varieties.											
U. 4.		S.G. 27.		N. 17 (Busoga).		S.G. 29.		N. 17 (Local).		S.G. 23.8.	Mean.
19.0	...	18.0	...	15.4	...	15.3	...	15.0	...	14.8	16.3

The variation between blocks was rather high, the extreme means being 12.2 and 21.5. The highest yielding blocks were those which had not been under recent cultivation.

Orungu.—The lay-out here was also of six random blocks, but the site was rather poor and again no significant differences were obtained. The mean yields per plot were:—

TABLE XVI.
YIELDS IN LBS. PER 1/40TH ACRE PLOT.

Varieties.											
U. 4.		S.G. 27.		S.G. 29.		N. 17.		S.G. 23.8.			Mean.
14.8	...	13.8	...	12.7	...	12.3	...	11.8	...		13.1

The low position of S.G. 23.8 is again evident, while S.G. 27 maintains a higher position than S.G. 29.

Kamuge.—The variety trial was sited on the small lukiko farm. The soil is a reddish loam and the conditions are generally typical of Pallisa County, but the soil is not as fertile as the rest of Bugwere. The lay-out adopted was a Latin square five by five, the plots being the same size as in the other experiments. Spacing and seed rate were also the same. The trial was sown on 5th July when conditions were at their best. The yields were low compared with those obtained at other centres; there was no outstanding feature amongst the varieties during the season except that S.G. 23.8 was not badly attacked by Jassid at this centre.

The results were as follows:—

TABLE XVII.

YIELDS IN LBS. PER 1/40TH ACRE PLOT.

Varieties.											
U. 4.	N. 17 (Local).		S.G. 27.		S.G. 23.8.		S.G. 29.		M.	S.E. Diff.	
10.8	...	9.9	...	9.6	...	9.1	...	8.5	...	9.6	... 0.63

YIELDS AS A PERCENTAGE OF THE MEAN.

Varieties.											
U. 4.	N. 17 (Local).		S.G. 27.		S.G. 23.8.		S.G. 29.		M.	S.E. Diff.	
113	...	103	...	100	...	95	...	89	...	100	... 6.56

The experiment showed significance by the "Z" test and gave the following results:—

U. 4 significantly higher yield than all varieties except Local.

Local significantly higher than S.G. 29.

The results of comparing N. 17 with S.G. 29 at this centre indicates that the former is more suited as regards yield to this area as in two consecutive seasons, both very different climatically, N. 17 has given a significant increase in yield over S.G. 29.

Kaberaimaido.—The lay-out here was in the form of a five by five Latin square, the plot size, etc., being standard. A good stand was obtained but heavy rain late in the season caused a great amount of boll shedding. The results are tabulated below and once again these do not satisfy Fisher's "Z" test. The positions of the varieties in order of yield are similar to those in the Teso trials, S.G. 23.8 being last again.

TABLE XVIII.

YIELD IN LBS. PER 1/40TH ACRE PLOT.

Varieties.											
S.G. 27.	U. 4.		S.G. 29.		N. 17 (Local).		S.G. 23.8.		Mean.		
21.8	...	21.6	...	21.4	...	18.4	...	16.0	...	19.8	

Ngetta.—This trial was similar to that at Kaberaimaido except that it was a six by six Latin square owing to the addition of N. 17 (Busoga). Again no significant results were obtained but the order of yield was similar to that at Kaberaimaido.

TABLE XIX.

YIELD IN LBS. PER 1/40TH ACRE PLOT.

Varieties.											
S.G. 27.	U. 4.		S.G. 29.		N. 17 (Busoga).		S.G. 23.8.		N. 17 (Local).		Mean.
14.0	...	13.0	...	12.9	...	12.3	...	12.1	...	11.7	12.7

Aduku.—A Latin square was impossible here owing to the very poor block available for the experiment and the lay-out was in the form of five random blocks. This trial was unexpectedly the only outside trial except for Kamuge, which gave significant results. It is interesting to note that whereas S.G. 27 is either top or next to top as regards yield in all the other trials, here it is at the bottom of the list with S.G. 23.8 as usual near the bottom. The yields were as follows:—

TABLE XX.

YIELDS IN LBS. PER 1/40TH ACRE PLOT.

Varieties.											
S.G. 29.	U. 4.		N. 17 (Local).		S.G. 23.8.		S.G. 27.		Mean.		S.E. Diff.
17.5	...	17.2	...	15.8	...	13.9	...	12.8	...	15.4	1.20

YIELDS AS PERCENTAGE OF THE MEAN.

S.G. 29.	U. 4.		N. 17 (Local).		S.G. 23.8.		S.G. 27.		Mean.		S.E. Diff.
114	...	112	...	103	...	91	...	83	...	100	7.8

Results.—

S.G. 29 and U. 4 significantly higher yields than S.G. 23.8 or S.G. 27, while there are indications that the increase of S.G. 29 over Local is significant.

Local significantly higher yield than S.G. 27.

Vukula.—The site chosen was on rather light sandy soil on the same plot as the quarter-acre trial plots in the previous season. The lay-out was in the form of random blocks and the results were not significant.

The yields were as follows:—

TABLE XXI.

YIELDS IN LBS. PER 1/40TH ACRE PLOT.—

Varieties.									
S.G. 29.		U. 4.		S.G. 23.8.		S.G. 27.		N. 17 (Local).	
25.5	...	24.5	...	24.4	...	23.9	...	22.7	

The general results of all these trials confirm the results obtained at Serere, namely, that U. 4 is not superior in yield and is definitely inferior in quality to S.G. 27, S.G. 29 and Local. S.G. 23.8 has been attacked by Jassids at nearly every centre and this alone makes it unwise to proceed further with this strain despite its excellent spinning qualities. S.G. 29, which is being distributed to replace N. 17, is generally giving higher yields than N. 17; only in two centres did N. 17 give a higher yield than S.G. 29.

EXAMINATION OF SAMPLES FROM THE VARIETY TRIALS.

Samples of seed cotton were examined from all the variety trials with the exception of Vukula and Aduku. The full results from these entail too many tables for inclusion in this report, but a few of the more outstanding points are discussed here.

The most striking point is the increase in the value for lint index as compared with that of last year when the influence of blackarm caused such a reduction in this character. Lint index values of over 6.00 were by no means uncommon. It is noteworthy that most varieties gave their highest lint index at Kamuge—the lowest yielding centre—while the figures from Labori with a yield of 2,000 lbs. were comparatively low, the figures being 6.42 for Kamuge and 5.65 for Labori.

With regard to staple, not much variation due to place effect is observed; Kamuge appears to have a depressing action on length except in the case of N. 17, which appears to be particularly suited to this centre, while Labori and Orungu produced lengths above the mean. It is noteworthy that U. 4 is definitely at least 2 mm. shorter than any other of the varieties at all centres, while S.G. 27 and S.G. 29 are both 1 mm. longer than N. 17. The general average length of all samples is just 30 mm.

With regard to ginning outturn and seed weight, which are closely correlated, considerable place effect is noticeable, for instance, Kamuge and Ngora giving the lowest seed weights give the highest ginning outturns. It is also remarkable that there appears to be a distinct relation in this season's results between high ginning outturn and lower yields—this is clearly shewn in the following table—the Ngora results being the only exception to the general tendency.

Centre.	Ginning outturn.				Yield per 1/40th acre.	
					lbs.	
Kamuge	...	...	...	37.5	...	9.6
Ngetta	...	...	...	34.3	...	12.7
Ngora	...	...	...	34.3	...	16.3
Orungu	...	...	...	34.1	...	13.1
Serere	...	...	...	33.8	...	16.3
Bukalasa	...	...	...	32.4	...	16.2
Labori	...	...	...	31.7	...	54.4

QUARTER-ACRE TRIAL PLOTS, EASTERN PROVINCE.

The results obtained from the quarter-acre trial plots of S.G. 29 and N. 17 last year showed that this method of comparison as an adjunct to the ordinary variety trials is likely to be very useful in deciding whether a new strain is worthy of distribution, and in addition they will when they have been carried on for several seasons give very valuable information as to the various yield and quality areas which exist in the Eastern Province. This season they were repeated at the same centres, but S.G. 23.8 replaced S.G. 29 as it appeared to be a better quality cotton than S.G. 29. Unfortunately, as has been mentioned above, the strain went down very badly to Jassids and has as a consequence been withdrawn. The results taken as a whole show no differences between the two strains, but taken district by district it is seen that S.G. 23.8 gives a higher yield than N. 17 in Busoga, especially in the elephant grass area (there were very few Jassids in this country last season), while in Bugwere, Budama, Bugishu and Lango N. 17 yields better than S.G. 23.8. The Bugwere results were undoubtedly affected by two centres where N. 17 gave a higher yield than S.G. 23.8, the difference between the two varieties being much greater than could be due to varietal difference, and this must have been due to very unlike plots. The Lango results must have been

partially due to Jassids. There is no practical difference between the two strains in Teso. The results are summarised in the table below—unfortunately it has been impossible to deal with all the samples from these plots so that the results of the examination of these cannot be included in this report.

It is interesting to compare the mean yields from these plots in the various districts with those obtained from similar centres in the previous season. In some cases more than double the yield has been obtained. That the Teso plots have yielded more than the Busoga plots is unusual, but they have been influenced by the yields at Labori out of all proportion to the extent of that high yielding area, the mean yield, excluding Labori, being 133 lbs. per quarter acre instead of 186.

TABLE XXII.
SUMMARY OF RESULTS OF QUARTER-ACRE TRIALS.

District.						Mean Yield per $\frac{1}{4}$ Acre.		
						S.G. 23.8	N. 17	N. 17 (1929-30)
						lbs.	lbs.	lbs.
Busoga	...	...	...	...	9	206	184	148
Bugwere	...	...	...	...	9	126	152	55
Budama	...	...	...	...	4	85	114	78
Bugishu	...	...	...	...	4	159	167	85
Teso	...	...	...	...	8	181	186	46
Lango	...	...	...	...	9	158	177	64
Mean						153	163	79

CHANGE OF SEED.

Owing to the severe attack of blackarm which occurred in Teso and Lango districts last season, a change of seed was considered advisable, and accordingly N. 17 seed from areas comparatively free from blackarm in Busoga was planted throughout Teso and Lango. In order to find out what effect this change of seed had Local N. 17 and the Busoga N. 17 were included in four of the variety trials: three in Teso and one in Lango. The germination was in favour of Busoga seed at all centres, being about 8% better than Local seed. There appeared to be no difference between the two with regard to infection by angular leaf spot. The final yields showed no differences whatsoever; as is seen in the table below there was a difference of 0.4 lbs. per 1/40th acre plot between the means in favour of Busoga seed; this of course is not significant, while in production of lint the Local seed produced 0.3 lbs. per 1/40th acre more than Busoga seed owing to a higher ginning outturn. Samples of seed cotton were examined from the four centres—these showed no real difference in mean staple length, Local being slightly longer on the average, but in every case the cotton from Busoga seed was very definitely more irregular than that from Local seed. Lint index gives no real differences, but the ginning outturn is higher in the case of Local seed. The general conclusions from the above experiments may be summarised by stating that the introduction of Busoga seed gave a better stand (in the neighbourhood of an 8% increase) than Local, but there was no difference in the final yields. The lint from Local seed was more regular than that from the Busoga seed and was slightly longer.

TABLE XXIII.
SUMMARISING RESULTS FROM COMPARING N. 17 FROM BUSOGA WITH LOCAL N. 17.

Centre.			Yield in lbs. per 1/40th acre.		Lint Length (in mm.)		Lint Index.		Ginning Outturn.	
			Local.	Busoga.	Local.	Busoga.	Local.	Busoga.	Local.	Busoga.
Labori	...	...	55.5	54.9	30.3	30.7	5.48	5.67	31.1	31.7
Serere	...	...	14.5	15.8	30.2	28.9	6.44	6.20	33.8	33.1
Ngora	...	...	15.0	15.4	29.6	29.4	5.12	5.03	34.3	30.9
Ngetta	...	...	11.7	12.3	30.7	29.5	6.80	6.37	35.2	32.0
Mean			24.2	24.6	30.2	29.6	5.96	5.82	33.6	31.9

SPINNING TESTS AND BROKERS' REPORTS.

The Empire Cotton Growing Corporation again very kindly made the arrangements for the brokers' and spinning tests, and our thanks are due to them, to Messrs. Wolstenholme and Holland, who graded the samples, and to the Shirley Institute and the spinning firm concerned who carried out the spinning tests.

The samples referred to below are from the 1929-30 season.

All the samples submitted were ginned on a full-sized Middleton roller gin, the lint being picked over after ginning. When possible the samples were drawn from mid-season pickings.

The results from samples from Serere and Labori variety trials are summarised in the table below:—

TABLE XXIV.

NOMINAL COUNT AND TYPE OF YARN—40's RING TWIST. TWIST CONSTANT—3·75.

Variety.			Lea Strength.		Strength x Count.		Brokers' Valuation based on Am. Middling 5'85d.	
			<i>Serere.</i>	<i>Labori.</i>	<i>Serere.</i>	<i>Labori.</i>	<i>Serere.</i>	<i>Labori.</i>
S.G. 27	...	...	53·3	55·2	2,143	2,241	7·35	7·20
S.G. 27.15.13	...	...	54·6	—	2,195	—	7·50	—
S.G. 29	...	...	53·8	56·8	2,125	2,232	7·30	7·85
S.G. 23.8	...	...	67·3	64·5	2,699	2,612	7·40	7·10
Local (N. 17)	...	...	53·6	56·3	2,219	2,241	7·60	7·10
U. 4	...	...	53·2	—	2,069	—	6·70	—
U. 4 (saw ginned)	...	...	51·9	—	2,086	—	6·90	—
Mean (excluding S.G. 27.15.13 and U. 4)			57·0	58·2	2,296	2,331	7·41	7·31

The most interesting feature of these reports is that while the broker quite definitely prefers the Serere grown samples to the Labori grown (except in the case of S.G. 29) the results of the spinning tests show the Labori grown cottons to produce a better and stronger yarn than the Serere grown ones except in the case of S.G. 23.8. The latter result is to be expected as the Labori conditions are very much more favourable to optimum growth and development than are those which obtain at Serere. The strain S.G. 23.8 stands out very definitely as producing the best yarn and it is unfortunate that this strain is so susceptible to Jassids.

The comparison of U. 4 roller and saw ginned shows the saw ginned to be worth 20 points on the roller ginned, while from the spinning reports the differences are too slight to be significant.

Continuous Planting Experiment.—This experiment was repeated on a smaller scale than previous years, only two plots (in pairs) of each treatment being retained. The results showed that the application of 1,800 lbs. of kraal manure per 1/20th acre has kept the fertility as regards cotton yields up to that of the rest of the Plantation which is under a definite rotation.

TABLE XXV.

			<i>Manured.</i>		<i>Unmanured.</i>	
Yield in lbs. per 1/20th acre plot	...	...	28·0	...	20·0	
Lint Length in mm.	...	...	29·5	...	30·2	
Lint Index	...	...	4·67	...	5·04	
Weight 100 Seeds	...	...	9·25	...	9·42	
G. O. T.	...	...	33·5	...	34·8	

These plots have now had cotton for six seasons out of seven, and this season is the fifth in succession under cotton only. Even now a comparatively good yield is being given by the untreated plots, although these plots are subject to considerable wash. There is no real difference between the quantitative characters of the seed cotton although the figures are slightly in favour of the untreated plots.

This experiment has now been discontinued as any further results will be of academic value rather than economic. The results obtained up to the present time

have shown us what they were intended to show, namely, that the application of kraal manure has a definite beneficial effect on the yield and also that cotton can be grown continuously on the same plot for some considerable period without seriously affecting the yield.

Supplement.—Since the main body of this report was prepared the results from the variety trials have been further analysed, and as these differ in some cases from those already given it was considered necessary to include the new results in the form of a supplement.

As in previous years the results from the variety trials have been worked out on the yields of seed cotton per plot, but this season the examination of samples of cotton from the various trials showed that there were considerable differences in ginning percentages between the varieties. The yields of lint per plot have been worked out for all centres except Aduku and Vukula from which no samples were received, and the result of this has been to show significance in two centres which gave no significance for seed cotton figures. The results are tabulated below (at the time of writing it has only been possible to work out the full Analysis of Variance at a few centres).

Bukalasa.—

YIELD OF LINT PER 1/40TH ACRE PLOT IN LBS.

<i>S.G. 23.8.</i>		<i>S.G. 27.</i>		<i>U. 4.</i>		<i>N. 3/5.</i>		<i>S.G. 27.15.13.</i>		<i>S.G. 29.</i>		<i>Local.</i>
5.2	...	5.7	...	4.8	...	4.6	...	5.1	...	4.6	...	5.8

In this case there has been practically no change in order of yield, the only one being a change of places between *S.G. 23.8* and *S.G. 27.15.13*.

Labori.—

YIELD OF LINT IN LBS. PER 1/40TH ACRE.

<i>S.G. 27.</i>		<i>S.G. 29.</i>		<i>S.G. 23.8.</i>		<i>Local.</i>		<i>Busoga.</i>		<i>U. 4.</i>
16.5	...	16.8	...	17.0	...	17.5	...	17.4	...	18.5

The Analysis of Variance has not yet been worked out for these figures. *U. 4* shows up as top yielder in this case and will probably be significant over *S.G. 27* and *S.G. 29*.

Ngora.—

YIELD IN LBS. PER 1/40TH ACRE.

<i>S.G. 27.</i>		<i>S.G. 29.</i>		<i>S.G. 23.8.</i>		<i>Local.</i>		<i>Busoga.</i>		<i>U. 4.</i>		<i>S.E. Diff.</i>
6.8	...	4.8	...	5.2	...	5.2	...	4.8	...	6.2	...	0.41

These results from Ngora are significant and show *S.G. 27* and *U. 4* to give significantly higher yields than any of the other varieties, while *S.G. 27* has attained top place at the expense of *U. 4*. This experiment gave no significance with seed cotton figures.

Orungu.—

YIELDS IN LBS. PER 1/40TH ACRE.

<i>S.G. 27.</i>	<i>S.G. 29.</i>	<i>S.G. 23.8.</i>	<i>Local.</i>	<i>U. 4.</i>	<i>S.E. Diff.</i>					
5.3	...	3.9	...	4.3	...	3.7	...	5.1	...	0.37

Here again *S.G. 27* has displaced *U. 4* at the top and significant results are obtained—*S.G. 27* and *U. 4* giving significantly higher yields than any of the other varieties.

The results from Kaberamaido were not significant, but *S.G. 27* was again top, while the results from Ngetta, although not yet fully worked out, show *S.G. 27* to be the highest yielder.

The general result of this method of working out has been to emphasise the superiority of *S.G. 27*.

While it would at first appear that working the results out on lint yields instead of seed cotton yields is of greater value in determining the best yielding variety, yet from the grower's point of view it would be dangerous to depend entirely on yields of lint, although it has been shown by Harland and others and also at Bukalasa this season that small seeded cottons do not necessarily give rise to small

and low yielding plants, yet there is the danger that if too much attention is paid to ginning percentages the grower may suffer. In this country the grower is paid according to the weight of seed cotton and it is very doubtful whether he would receive any benefit from an increased ginning outturn except in very exceptional circumstances. On the other hand, the position might quite conceivably arise that the ginning outturn would be increased and the weight of lint per acre increased, but at the same time the total yield per acre, *i.e.*, the yield of seed cotton, might actually decrease and the grower get even less for his cotton than previously. Thus, as far as Uganda is concerned, account of the yield of seed cotton will have to be taken until such a time arises when we can be certain that the grower would get full benefit of any increased ginning outturn.

G. W. NYE,

Cotton Botanist.

ANNUAL REPORT OF THE GOVERNMENT ENTOMOLOGIST.

The Entomologist was on duty during the whole of the year. The Assistant Entomologist was absent on home leave from April 12th until October 14th; he attended the Third Imperial Entomological Conference held in London during June.

2. Tours for advisory and inspection purposes involved absence from headquarters totalling fifty-five days. Seven visits were paid to investigate insect pests on estates owned by non-natives. As usual, many plots of food and export crops cultivated by natives were inspected.

3. Investigational work by the Entomologist was devoted mainly to studies of pests of the native-grown crops:—Maize, sorghum, ground-nut, sweet potato, sim-sim, pigeon pea, beans and banana. Circumstances did not allow of any special studies of coffee insects, but further information on these was obtained as opportunity permitted.

4. Attention was directed particularly to the seasonal prevalence of insects with a view to determining what season, if any, is the less favourable to damage by insects. For sim-sim and maize, there was strong evidence that in certain areas these crops should be planted during the later part of the year. It cannot, however, be assumed that the later planting season is generally the best for these crops under the widely-varied conditions of different parts of Uganda; before any reliable conclusions can be reached, observations must be made in all areas and over a number of years.

5. The Entomologist's conviction, that a correlation exists between environment (weather, soil, cultivation, etc.), and the prevalence of sucking insects on plants, has received further support during the year. To obtain experimental proof and to determine the various factors involved will require intricate and prolonged investigations, and it is a problem which can be undertaken only at a station where long-range research is possible. This aspect of control of insect pests is considered by the Entomologist to be of fundamental importance and he has submitted it for inclusion in the programme of research at the Amani Institute. A repetition of trials of ground-nut varieties in connection with "rosette" disease, which is transmitted by plant bugs, confirmed previous results and conclusions: that varieties which are immune or resistant to the disease in certain environments may be susceptible in other environments, and that the degree of resistance to the disease depends on the degree of suitability of the environment for any particular variety—under suitable conditions the plant sap (the food of the insect vectors) either proves more attractive, or is altered chemically so as to render possible an enormous increase in the rate of reproduction.

6. The Assistant Entomologist was engaged mainly on investigation of cotton insects. Special attention was paid to the determination of causes of bud and boll-shedding (continuation of previous studies), to the seasonal prevalence of insects, and to the determination of the economic status of the various pests of cotton. It was estimated that the total loss of potential crop owing to various causes is far in excess of the total clean crop, and that the loss of crop due solely to insect attack approximately equals the amount harvested. Insect damage to cotton is rarely spectacular, but each

pest contributes its quota, varying in extent as the conditions which affect insects and plant, and the total loss is enormous.

7. During the above-mentioned conference the Assistant Entomologist discussed with Mr. King (Sudan Government Entomologist) the possibility of the natural spread of pink bollworm of cotton into Uganda from the Sudan. Mr. King stated that this pest must already have crossed the border. In view of this statement, and of the fact that in Tanganyika the insect does not have a resting stage in cotton seed, a tour was projected in December to investigate the position in West Nile and Gulu. The project had to be abandoned in order to enquire into the possible implication of Jassid bugs in the transmission of "blackarm" disease of cotton. The results of experiments and of limited field observations were negative; it would appear that, even if the bug is capable of transmitting the disease, climatic conditions which cannot be controlled are primarily, and possibly almost solely, responsible for epidemics of "blackarm." The question of transmission of "blackarm" was discussed by Mr. Hancock with Mr. Stoughton at Rothamsted; the conclusion reached was that no cotton insect common in Uganda had the feeding habits necessary to infect the plant at the point where infection is believed to occur.

8. In addition to the visits to Cambridge, Rothamsted and Farnham Royal Parasite Laboratory arranged for Entomological Conference, Mr. Hancock, in order to obtain the latest information on certain aspects of problems in Uganda, visited the following institutions:—Imperial Institute of Entomology and British (Natural History) Museum, Kew Gardens, London School of Tropical Medicine, and Wellcome Field Laboratory.

9. The invasion by the Desert Locust (*Schistocerca*) recorded in the report for 1929 continued during 1930, and occasional swarms were recorded during January and February in various parts of the country. During July a swarm was reported from Chua and in November a swarm in Usuku. Some damage was caused to cotton, millet, cassava and sweet potato. No further breeding occurred in Uganda and action against locusts was confined to driving the swarms off cultivation.

10. Advice was sought on the subject of termites attacking cotton, sugar-cane setts, and buildings. Requests for assistance were also received regarding pests of coffee, sweet potato, banana, maize, lilies and garden peas. Among the specimens received for identification were numerous *Glossina*, other biting flies, and other *Diptera*; six collections (mixed species) of ticks; numerous insects of various orders from a mission school.

The necessary attention was given to the reference collections of insects and ticks, to which were added numerous accessions; donations of specimens were received from Messrs. G. W. Poole, G. H. E. Hopkins, T. Chorley and W. W. Soundy.

11. Assistance was rendered in the preparation of lectures in entomology for students of agriculture. Further exhibits were set up in the laboratory museum. Publications comprised:—A revised circular on coffee bug; a circular on the common sweet potato caterpillar (English and Luganda); notes on Uganda mosquitoes (*Bulletin Royal Entomological Society, Egypt, XIV, p.p. 38–56*); notes on the fauna and flora of Mount Elgon—in collaboration with Mr. W. W. Soundy (E. Africa and Uganda N. H. Society). The last two were written by Mr. Hancock.

12. The native artist was fully occupied. He made numerous drawings of immature insect stages, took almost complete charge of the rearing of insects, and assisted generally with experiments and field observations.

13. The total number of packages of imported plants received for inspection during the year was 139.

14. The Director and staff of the Imperial Institute of Entomology have continued to render invaluable assistance. The following specialists have kindly named specimens for the reference collection:—M. Banninger, M. Beier, Bernhauer, K. G. Blair, A. Boucomont, L. Burgeon, W. E. China, C. L. Collenette, F. W. Edwards, H. Eggers, J. J. Gillet, E. Heinze, R. Kleine, P. Lesne, E. Meyrick, M. E. Mosely, J. Omer-Cooper, M. Pic, A. E. Prout, L. B. Prout, A. Reichensperger, M. Schmidt, V. G. L. van Someren, F. Spaeth, W. H. T. Tams, A. Thery.

H. HARGREAVES,
Gouvernement Entomologist.

ANNUAL REPORT OF THE MYCOLOGIST.

1. I have been on duty throughout the year. During January a tour of inspection was made of the Bunyoro District and the Eastern Province, in connection with the severe outbreak of blackarm disease of cotton. A second tour of Teso was made in July, when the new crop of cotton was germinating, to gather information on the extent of primary infection of the crop with *Bacterium malvacearum*, the causal organism of this disease. Apart from these two tours, travelling was limited to visits to various estates.

PLANT DISEASES DURING 1930.

2. *Cotton Diseases, 1929-30 Season.*—This season was remarkable for the severe outbreak of blackarm disease over large areas of the Eastern Province. An account of this disease is given as Appendix I of this report.

The internal boll disease caused by *Nematospora gossypii* appeared to be of considerable importance in Teso during this season. The relatively light crops obtained as the result of blackarm damage were further reduced in quality by the considerable proportion of stained cotton present as the result of infection by this disease.

Rhizoctonia bataticola was of frequent occurrence on the roots of plants in areas severely affected with the blackarm disease, and in some instances it appeared to complete the destruction of the crop. All evidence obtained from laboratory experiments in Uganda indicates that this fungus is a very weak parasite of cotton, and in the present instance is probably to be regarded as a secondary parasite following on the general ill-health of the plants.

3. *Cotton Diseases, 1930-31 Season.*—During this season the blackarm disease was of much less importance to the crop than in the previous season. New seed was imported into the districts severely affected during 1929-30, from areas in Busoga which showed little damage during that season. Further information on this disease is contained in Appendix I.

Nematospora gossypii caused much less damage this season than in 1929-30. Dysdercus stainers were later in appearance than during the previous season, as observed in Kampala.

Rhizoctonia solani caused some damage in the seedling stage of the crop, especially during the unusually dry months of July and August in Buganda.

Rhizoctonia bataticola was much less common on the roots of the crop than in the previous season.

A peculiar disease, known amongst the natives of Buganda as "Kigabi," was noticed to be common in cotton plots in this district during the season. The leaves of apparently robust plants suddenly wilted, and turned brown in the areas between the main veins. Subsequently the leaves quickly dried up and were shed, leaving the plants as bare sticks. Such plants were sporadic in occurrence in the plots, not noticeably in groups, and were found in almost every cotton plot. Some cases of partial recovery were noticed, but during the dry months of January and February most of those affected died off completely. In the stems were discoloured lines in the wood, containing hyphae of a *Fusarium* sp. Whether this fungus can be considered as the primary cause of the disease is doubtful, as inoculation of the fungus into the wood of healthy plants at ground level gave no positive results. On the other hand the sporadic occurrence of the affected plants gives no evidence that the disease may be due to a soil effect, and also as yet no evidence of any spread of the disease from one plant to those adjacent has been obtained.

4. *Other Plant Diseases in 1930.*—A disease not previously reported in Uganda was found in coffee berries from Toro district, where the coffee bug, *Antestia* sp., has been very prevalent. The berries appear normal on the trees, but the enclosed seeds are shrivelled and discoloured. The affected seeds contain the fungus *Nematospora coryli*, and the disease is identical with that described by Wallace in Tanganyika Territory, who has also obtained evidence that the fungus is carried by the bug *Antestia*. Control of this disease is obviously limited to the control of the insect carrier, without which the disease cannot affect the crop.

No reports of serious outbreaks of other coffee diseases were received during the year.

Other diseases recorded during 1930 are the following :—

Heterodera radicola on coffee, both *arabica* and *robusta*, on tea seedlings, and on tobacco.

Gibberella Saubinetii causing a rot of maize cobs.

Rhizoctonia bataticola causing a rot of the tubers of sweet potato ; also on the roots of cotton, groundnuts and tea seedlings.

Cercospora sp. causing a leafspot of tobacco.

Cercospora sesami on sesame.

Helminthosporium leucostylum causing a leaf blight of *Eleusine coracana*.

Colletotrichum sp., *Cercospora* sp., and *Ascochyta* sp. together causing a severe spotting of the leaves and pods of all kinds of beans.

Macrophomina phaseoli, pycnidial stage, on stems of sesame.

Alternaria solani on Irish potato.

Fusarium moniliforme causing a tip rot of the fruits of several varieties of bananas.

B. campestris causing "Black Rot" of cabbage.

A bacterial rot of Irish potato, possibly "Black Rot" due to *B. phytophthorus*.

5. *Sugar*.—During the year a considerable interest has been shown by several planters in this crop. Supplies of setts of the best varieties in the Kampala nursery were sent to those interested.

The only disease of economic importance is the Mosaic Disease. This has now been found on the two largest estates here, and also in several native holdings close by these. Its presence in the latter indicates that in the future we shall be unable to eradicate the disease from the sugar growing areas of Uganda, and shall be forced to fall back on the resistant P.O.J. varieties. Fortunately these varieties, especially Nos. 2714, 2725, 2727 and 2878 are proving of great value here as sugar producers, apart from any question of resistance to disease. Present indications are that 2878 and 2725 are the two best cane varieties in Uganda, and in the near future it is likely that these two varieties will replace all others. They appear to give a larger tonnage of cane per acre and that of good quality, while 2725 ripens very early, thus reducing the interval between successive ratoon crops. The cultivation of these varieties is thus likely to reduce the costs of sugar production in Uganda, a very important feature in view of the recent large reduction in the market price of the product.

A new disease to Uganda was discovered during the year on some young ratoons in the Kampala nursery. It was indentified as Red Stripe, due to *Bacterium rubrilineans*. Examination of cane on estates supplied with setts from Kampala nursery failed to reveal any sign of the disease. An attempt was made at total eradication of the disease from the nursery, by burning all infected material, digging out the stools and burning them. Three months later a few more cases were found, but since the destruction of these no more infections have been discovered. Hitherto the disease has been limited to young ratoons of P.O.J. 2727.

With reference to Mosaic Disease in Uganda it is of interest to note that the two varieties P.O.J. 213 and P.O.J. 2379 have proved very susceptible to infection here, though they appear to be very tolerant of the disease. Both of these varieties have become 100% infected under estate conditions, and further extension of these varieties is not recommended. The varieties of cane imported in 1927 from the West Indies, chiefly Barbados varieties, have proved of little use in Uganda, as they are too susceptible to Mosaic, which affects them much more severely here than in the West Indies. The only exception to this general susceptibility of the "soft" canes to Mosaic in Uganda is the Striped Ribbon, which has long been the standard estate cane here. This, while not resistant to infection, suffers much less from the effects of the disease here than the other soft canes.

6. *Laboratory Work*.—Most of my time has been occupied with research on the blackarm disease of cotton. An account of this is contained in Appendix I.

A preliminary survey of the rots of the tubers of the sweet potato was commenced during the year. The most frequent rots are caused by *Rhizoctonia bataticola*, a form with small black sclerotia and identical in culture with that obtained from the roots of cotton and similar small plants, and which is probably to be connected with the pycnidial form *Macrophomina phaseoli*. *Diplodia theobromæ* is

also common as a parasite on these tubers, and is usually associated with damage to the surface tissues, usually caused by insects. The former fungus appears to be able to attack undamaged tubers at a comparatively early stage in their development.

A wet rot of the tissues lying immediately under the surface was due to a fungus which is related to *Pythium*, but attempts to induce fructification in culture have failed, so that identification is as yet impossible.

7. *Herbarium*.—A large number of specimens of Uganda fungi were added to the herbarium during the year, and a descriptive catalogue, together with drawings of a large number of species, was compiled from the records here together with those obtained at Kew during my leave in 1929. This catalogue has been made as complete as possible from the records available, and is being added to as further collections are made, with the object of forming the basis for a flora of the fungi of Uganda.

From time to time, as was possible in the intervals of other work, assistance has been given to the Botanist in his herbarium.

9. In conclusion, I have to thank the staffs of the Imperial Mycological Institute and of the Royal Botanic Gardens, Kew, for their valuable assistance in all branches of my work.

C. G. HANSFORD,
Mycologist.

Appendix I.

The following account has been prepared with the assistance of Mr. G. W. Nye, Cotton Botanist and of Mr. C. E. J. Biggs, Agricultural Officer, to whom I am much indebted for their valuable help and criticism. It will be understood that the account is merely an attempt to summarise our observations on this disease in Uganda during 1929-30 and 1930-31 and that the hypotheses put forward may be entirely revised or rejected as further experience of the disease is accumulated. It is not suggested that these hypotheses are applicable to other cotton growing countries.

Blackarm Disease of Cotton in Uganda.

1. GENERAL.—Prior to Snowden's publication on the "Occurrence of Angular Leaf Spot of Cotton in Uganda" in 1926, we have little evidence regarding the distribution of the disease here. A number of records of damage to cotton by an unidentified disease are contained in various reports of Agricultural Officers. There is indication that some of these reports may refer to this disease. Apart from these reports, the first definite record is that of Snowden, referred to above, the disease being described as common during the 1925-26 season. Since then more records are available. During the 1926-27 season the cotton at Serere Plantation was badly affected by hail storms, but a considerable amount of blackarm was present in addition. During the following season, 1927-28, little damage was reported from this disease.

During 1928-29 the cotton crop in the northern and eastern parts of Teso district was severely affected and a very small crop was produced.

The 1929-30 season will be remembered as that in which the disease first became of primary importance to the Protectorate, in so far as it occasioned a great loss of crop over a wide area in the most important cotton producing parts of the Eastern Province. The area affected was much larger than that of the preceding season, and extended over the whole of the Eastern Province with the exception of the wetter area around Mt. Elgon and the Nile part of Busoga.

The general appearance of the cotton plots in the severely affected districts was pitiful, the plants in many plots being dwarfed and stunted, having shed the primary leaves, and developed a mass of short shoots and tiny leaves, many of these being deformed and rapidly developing a red pigment. Examination of the roots of such plants showed a similar effect, the root system being confined almost invariably to the top six inches of soil, with only a thin, underdeveloped main root entering the deeper soil layers.

This poor development of the root system was apparently due to the hard dry nature of the soil below six or eight inches depth, into which the roots were unable to penetrate. From observations made during the 1929-30 and the 1930-31 seasons it would seem that the occurrence of this hard subsoil layer may prove to be one of the major factors in the development of an epidemic of the disease under Uganda conditions.

Examination of a large number of cotton plots in the various districts visited gave evidence that the disease had appeared first in Teso and in the eastern part of Lango, and at a later stage in the development of the plants in areas away from this centre. In some areas of Bugwere district, little damage was done before the beginning of January, when the disease suddenly increased, and caused the loss of a considerable proportion of the bolls already on the plants, by causing them to open prematurely.

For the 1930-31 season seed was taken from the areas in Busoga where little damage was done by the disease during the previous season, and used to replace the seed in the areas which had then suffered more severely. Examination of plots in Teso during the early part of the season showed that in spite of this change of seed, there was an appreciable amount of infection on the cotyledons

and young leaves of the seedlings. In almost every plot there were a few plants showing leaf infection, and in consequence of this it was feared that a repetition of the severe infection of the previous season was to be expected. At this stage, however, no sign of the stem form of the disease was discovered. As the season progressed the angular leaf spot form of the disease increased in incidence all over the country, and some cases of stem infection were reported, though in most cases these were stated to be occasional and not partaking of the nature of an epidemic as in the previous season.

In the Kampala district leaf infection began to show a rapid increase during late September, this increase continuing through October. During November, the increase of infection slowed down and in December and January the infection gradually dwindled away to small amounts, by the natural shedding of the older infected leaves of the plants. By the middle of February the infection was limited to only a few leaves on most plants, an occasional exceptional plant still showing infection on most of its leaves. During the whole season stem infection was comparatively rare, and only occasionally severe enough to affect the development of the plant.

Reviewing the history of the disease during this 1930-31 season, it may be stated that although the causal organism, *B. malvacearum*, was generally distributed all over the country, even in the early stages of the crop, and though it subsequently increased in incidence until every cotton plant showed infection, in very few areas did stem infection become at all important in its incidence, and during the fruiting stage of the crop the infection gradually died out, with the result that a normal, and comparatively clean, healthy crop was obtained.

Infection on the bolls appeared to be less important this year than last, and in consequence fewer reports of the premature opening of the bolls from this cause were received.

2. THE RELATION OF "ANGULAR LEAF SPOT" TO BLACKARM.—During 1930-31 a large number of inoculations were carried out, both in the Laboratory and in the field. To summarise the results obtained, it may be stated that by merely spraying a cotton plant with a culture of the causal bacterium, only the leaf spot form of the disease is obtained, and that only under special atmospheric conditions, of which a high humidity is all-important.

Spraying plants with *B. malvacearum* during the late evening or in the early morning gave many more infections, but only on the leaves. The amount of infection obtained by this method of inoculation apparently corresponds closely to the rate of evaporation of the water from the suspension after spraying on the surface of the plant. If evaporation is too rapid the suspension apparently dries out before the bacteria can penetrate through the stomata and infect the plant. If the tissues are wounded infection is not so clearly dependent on atmospheric conditions. In all experiments where the bacteria were sprayed on undamaged tissue of the plant, infection was limited to the leaves and bracts of the bolls. No case of infection on the stems or branches, or on the boll wall has been obtained under such conditions. On the other hand if the surface is damaged infection readily takes place on any aerial part of the plant.

Under natural conditions in the field, in a plot kept under observation, over 75% of the total blackarm lesions found in the plot bore a definite relation to infected leaves. In these cases the lesions had obviously started at the junction of the petiole with the stem and had spread downward through the cortex and phloem tissues from this point.

Following up this observation it was found that leaf infection can be divided into two types, both of which have been obtained by simple spraying of the leaves under moist conditions. The first type of leaf infection consists of scattered angular spots over the blade, and apparently this type of infection is not related to the development of stem lesions at the base of the petiole.

The second type of leaf infection often appears on the leaves at an earlier stage in their development than is the case with the former type of infection, though this is not always the case. When the leaf is mature the lesions are seen to be limited to the tissues along the main veins, with extensions from them into the blade of the leaf. In many cases the whole leaf is deformed and wrinkled, obviously a result of the infection having taken place while the leaf was comparatively young and having prevented normal extension of the main veins, while the unaffected tissues of the parts of the blade between these veins continued their development. This appearance somewhat simulates the "leaf curl" described in Nigeria and the Sudan, but closer inspection reveals no proliferation on the lower surface of the veins, which is considered the chief diagnostic character of this serious virus disease. No evidence of the presence in Uganda of this "leaf curl" disease has been discovered to date. From observations made during the 1930-31 season it appears that the second type of leaf infection by *B. malvacearum* described above is often followed by the development of stem lesions from the base of the petiole. This extension of the bacterial infection through the tissues of the petiole is apparently dependent to a large extent on atmospheric conditions, as during a long dry period it rarely occurs. Under such dry conditions it would appear that the tissues of the drying leaf and petiole dry out too rapidly to permit of the passage of the bacteria, or alternatively it may be that the development of the abscission layer at the base of the petiole is more rapid under these conditions and cuts off the infection from the tissues of the stem. Observations made during the season 1930-31 indicate that the development of this form of stem infection is common only in showery weather.

In the field another type of stem infection has been observed in some cotton plots, in which the lesions are situated on the branches between the main stem and the first node, and bearing no relation to leaf infections. At present the origin of this type of infection is not known, though there is a possibility that hail storms may play some part in it, as many infections occur on the upper surface of the branches, and are often, but not invariably, associated with damage to the tissues.

Thirty isolations were made during the 1929-30 season from leaf infections, stem infections and boll infections. These cultures were used in inoculation experiments on all aerial parts of the cotton plant during the following season, and though some cultures proved more virulent than others, no constant difference in pathogenicity corresponding to the origin of the culture from stem, leaf or boll could be determined. In other words, there is no constant difference between strains isolated from various parts of the host plant, and all forms of the disease are caused by the same organism.

In culture a certain amount of variation has been observed between the various isolations made, chiefly in the reactions when grown on sugar media, especially those containing saccharose, but the differences do not correspond to the origin of the cultures from leaf or stem, and are characteristic of certain individual cultures only.

3. SYSTEMIC INFECTION OF THE HOST PLANT.—The sole evidence of the spread of the bacterium within the tissues of the host plant under Uganda conditions in 1930-31 is that of the passage of the bacteria through the petiole from the main veins of the leaf into the tissues of the stem. Even here the presence of the bacteria in the petiole is visible microscopically, giving a translucent appearance to the tissues.

Attempted isolations from apparently healthy tissues of the stem, even in the case of plants showing rather severe infection, have given consistently negative results. Hitherto, no evidence has been obtained in Uganda in support of the theory of systemic infection of the host, put forward by Massey in the Sudan (*Empire Cotton Growing Review*, VI., 124, 1929).

4. THE RELATION OF THE DISEASE TO THE INSECT PESTS OF COTTON.—Work on this aspect of the disease has been carried out in collaboration with the Assistant Entomologist. To date no experimental evidence of association or causation between incidence of the disease and Jassid attack, *Lygus* attack, or severe infection by aphids has been obtained. From time to time it has been suggested that Jassids might possibly be associated with epidemics of blackarm, but from the negative results obtained hitherto from experiments, it would appear that in such cases of apparent association the insect and disease are independent of each other, except in so far as both are much more severe on weakly plants.

5. BOLL INFECTION.—The lesions observed on the bolls fall into two groups, those at the base of the boll and extending down the pedicel, and those on the boll walls.

During the 1930-31 season boll infections in the field were comparatively rare, and observations on their occurrence and probable origin are as yet too few to allow of any conclusions being drawn from them. Present indications are that the first type of boll infection is correlated with infection of the bracts extending to the base of the boll by way of the tissues of the pedicel.

Inoculations by simple spraying of the bacteria on to the unwounded surface of the bolls failed to give positive results during this season.

6. INFECTION OF COTTON SEED.—Twenty-four samples of seed of the 1929-30 crop from various ginneries were examined in the laboratory for the presence of *B. malvacearum*. Some samples were taken from severely affected areas, others from areas in which little damage occurred. Twenty-five seeds were used for test in each examination, and from the exterior of these eight cultures in all were isolated which corresponded in cultural and pathogenic characters to *B. malvacearum*. Another 25 seeds from each sample were carefully delinted with sulphuric acid, washed, and the husks removed. The contents were surface sterilised with mercuric chloride and after washing in sterile water were transferred to tubes of broth. From these tubes after an inoculation period of 48 hours, a series of isolation plates were made. No evidence of the presence of *B. malvacearum* in these seeds was obtained. Over 75% of the seed proved sterile, even when left to incubate for five days, others gave cultures of various saprophytic bacteria. In addition 1,000 seeds from each sample were sown as a germination test. A small proportion of the seedling showed leaf spots due to *B. malvacearum*, but the amount of infection in each sample could not be correlated with the amount of disease recorded in locality of origin. In three samples a few seedlings showed stem infection at the junction of the cotyledons with the stem, and these seedlings without exception finally died. This limited experience with severe seedling infection would indicate that this type of infection is likely to bear no relation to the subsequent disease history of the crop.

All experience with the disease under Uganda conditions indicates that seed infection is almost entirely limited to the exterior of the seed. Instances of internal infection have been recorded, but these still appear to be exceptional.

Experiments have been carried out with a view to discovering the origin of infection on the seed, but have given no clear results this season.

7. DEVELOPMENT OF PLANTS FROM INFECTED SEED.—As recorded above, a limited experience in Uganda with infected seed appears to indicate that where seedling infection occurs on the stem it is unlikely that the seedling will grow to maturity. Infection on the cotyledons and leaves appears to have no effect on the subsequent development of the seedlings, and its spread on the aerial parts of the plant depends largely on the meteorological conditions, as discussed below.

8. RELATION OF THE DISEASE TO METEOROLOGICAL CONDITIONS.—Under Uganda conditions the angular leaf spot form of the disease is almost universal every year, while epidemics of the stem form are comparatively rare and localised. It therefore appears likely that external conditions of climate and soil play a great part in the development of the stem disease, which bears no correlation in incidence with the leaf form.

The development of the stem form of the disease as a result of the infection from the main veins of the leaf passing down the petiole into the stem has been described above, as occurring only during stormy weather. The tables in Appendix II show the disease history and meteorological records of an observation plot at Kampala during the 1930-31 season.

As an example of the effect of weather conditions on the disease it may be mentioned that a plot of land on the Bukalasa Plantation was severely attacked during 1929-30 and yielded 25 lbs. cotton per acre. The same plot, with no manurial treatment, yielded 600 lbs. per acre during 1930-31 season, in spite of the fact that the leaf form of the disease was plentiful at an early stage in the development of the crop.

9. EFFECT OF BLACKARM ON THE PLANT.—After stem infection has taken place, its subsequent history in relation to the plant appears to depend entirely on the general health and development of the individual plant, as modified by climatic and soil conditions. In the plot kept under observation during the 1930-31 season it was found that plants growing on poor patches of soil were very susceptible to this form of the disease. The lesions spread rapidly in the cortical tissues, and often completely ringed the stem, with the result that the latter broke off at this point. Subsequently a few of these plants sent out branches from points below the lesions, and then developed in a normal manner, but owing to the great check on the development of the plant as a whole, practically no crop was produced. Thus even in such cases of severe infection it is demonstrated that the plant has a considerable power of recovery from the attack of this disease provided climatic conditions are suitable.

In the case of stem infection on more robust plants growing on better patches of soil in the same plot during this season, the lesions formed during wet weather in October, rapidly dried out in November—December, and were cut off by cork layers. Such lesions apparently had little or no effect on final crop production during this favourable season.

These observations indicate that under favourable climatic and soil conditions the cotton plant is able to throw off both leaf and stem attacks of this disease and to make a complete recovery. This is supported by evidence obtained in all cotton plots observed in Buganda this season; large numbers of plants showed old dry lesions toward the base of the main stem, having been cut off by cork layers and dried out; the plants subsequently produced a normal crop. This crop recovery during a favourable season is to be contrasted with the great damage caused by the disease in the 1929-30 season, when large numbers of the plants were completely stunted and produced very little crop.

10. RELATION TO SOIL FACTORS.—The following account has been compiled by the Agricultural Chemist. The great difference between the history of the disease during 1928-29 and 1929-30 and that during 1930-31 in Teso and neighbouring districts was associated with a striking difference in the character of the soil. In the former season, as recorded above, the root development of the plants was severely restricted by the hard dry character of the soil below a depth of about six inches. The whole root system of the plants was restricted to the surface layers of the soil, and the roots were unable to penetrate deeper.

The subsoil in these districts is naturally very stiff and when dry is too hard for adequate penetration by the root system of the cotton plant; when moist the roots penetrate much more easily. Thus the whole development of the plant hinges upon the state of the subsoil at the time when the young roots of the seedling reach it. If it is dry and hard the roots are unable to penetrate it and turn and occupy only the surface layers of the soil, with the result that the plants are liable to be severely affected by comparatively short periods of dry hot weather.

If during the subsequent months the rainfall is well distributed the plants are able to develop, and as the lower soil layers become moister the roots are able to penetrate them, and more or less normal development of the crop results.

It appears, therefore, that the development of the crop depends largely on the state of the subsoil at the time of planting, and this again is the result of the previous rainy season. If the rains during this season, March to May, are normal in amount and well distributed, continuing into the planting season of June and July, the roots of the seedlings are able to penetrate at once into the subsoil, with the result that the plant is much more resistant to adverse conditions.

To summarise, if the top of the subsoil is dry when the young roots reach it, the crop will develop in a normal manner only if the rainfall is very even, and well distributed over the whole of the growing season. If the top of the subsoil is wet when the seedling roots reach it, these can penetrate and a reasonable freedom from disease can be anticipated.

In this connection it is interesting to note that the disease in 1929 started in south-eastern Lango and northern Teso on light soils of poor water-holding capacity. Sowing was started at the first rains after a long dry period, when there was a distinct hard layer of soil at six to nine inches from the surface. After light planting rains, there was a pronounced dry period, so that the plants had a very poor start. In Buganda the disease occurred on a similar soil under the same conditions.

In 1930 the soil during the planting season was much wetter and the rains were more evenly distributed, with the result that these same areas have yielded better cotton than in recent seasons.

11. VARIETAL RESISTANCE TO *B. malvacearum*.—During the 1930-31 season at Bukalasa careful observations were made by the Cotton Botanist in his breeding plot in order to ascertain whether any varieties were more resistant or more susceptible than others to this disease. Very definite differences were observed, *e.g.*, strains of S.G. 99 families originally derived from the "Allen" variety gave 100% of leaf infection within three weeks of the first appearance of the disease, whereas B. 31 showed no sign of infection throughout the season, although it had every chance to become infected, being planted between two infected rows, with constant movement of native assistants along the rows while tying flowers every morning.

A further interesting point noticed by the Cotton Botanist is that the indigenous cotton, a strain of *G. brasiliense*, was the only cotton at Bukalasa to be badly attacked by blackarm during this season. This would indicate that the disease must be of recent introduction into Uganda, as otherwise this native cotton would not have survived. Also strains of "Allen" have proved very susceptible to the disease, yet for the period it was in general cultivation no records of a bad attack are available, indicating that it is probable that the disease was introduced subsequent to the introduction of this variety, quite probably with the Nyasaland Upland variety.

12. SEED TREATMENT.—During the season 1930-31 a rough test of the effect of delinting seed with sulphuric acid was made at Bukalasa and Serere Experimental Stations. The results are tabulated as follows :—

From observations made at Bukalasa during the early part of the season it appears that the plants originating from treated seed remained comparatively free from angular leaf spot for some time after the plots planted with untreated seed showed considerable infection.

At Serere both treated and untreated plots developed angular leaf spot and blackarm lesions, though the effect on the yield of cotton was not apparent. No difference could be detected between the plots, and apparently no benefit was derived from the treatment of the seed.

13. EFFECT OF SOURCE OF SEED.—As recounted above, for the 1930-31 season the seed used in those parts of the Eastern Province which had suffered severely during the previous season was imported from parts of Busoga where the disease had been much less severe. In this connection it is of interest to note that the Cotton Botanist included in his large series of variety trials a test of this imported seed against seed obtained from the local ginneries from the badly diseased crop. The results showed that in the crop produced, in no case was there any significant difference between the two sources of seed, thus indicating that in a favourable season as regards general history of the disease, the selection of the seed from the most healthy districts available is a secondary consideration, and has no effect on crop produced, as long as germination is sufficient to give a good stand of plants.

In the same season a test was made of seed from a badly diseased crop at Katakwe from a less severely affected crop at Mukura, and from a very slightly affected crop in Buganda. The three samples of seed were sown at Serere and at Bukalasa with the following results :—

At Bukalasa the stand of the Mukura seed was significantly better than that of the other samples; a small amount of angular leaf spot was present during the early stages of the growth of all the plants, but no stem infection developed. No significant differences in yield were obtained.

At Serere the Senior Agricultural Officer reports that the seed from all three sources produced normal crops, and no difference was apparent between the Katakwe seed and that from Mukura, though the seed from Buganda gave a better yield, probably to be accounted for by the better stand of plants and also possibly by difference in variety. The same officer concludes that given a season in which blackarm does not become epidemic, there is no advantage in importing fresh seed into areas badly affected during the previous year, as long as a good stand can be obtained, if necessary by increasing the seed rate per acre. With this conclusion I am in perfect agreement.

14. SUMMARY.—From the information obtained to date on the behaviour of this disease under Uganda conditions, both from observations in the field and from experimental results, we can only conclude that the development of such an epidemic as that of 1929-30 is chiefly dependent on climatic factors. These factors of climate act directly on the rate of spread of the disease from plant to plant, and on the incidence of stem infection; but their effect is also indirect, through the medium of the soil, by controlling the development of the plant and by modifying its resistance to the disease.

Appendix II.

Records of Observation Plot, Kampala, 1930-31.

The plot was planted on July 28th—30th, 1930. Owing to continued dry weather germination was very poor and slow. No signs of infection were found on these seedlings.

The blanks were resown on 22nd August and germination was good. Repeated examination until 15th September failed to reveal the presence of the disease.

On 4th October 223 plants were showing infection.

On 13th October 250 additional infected plants were found.

On 21st October 80 " " " " "

On 27th October 400 " " " " "

By 3rd November infection was general throughout the plot.

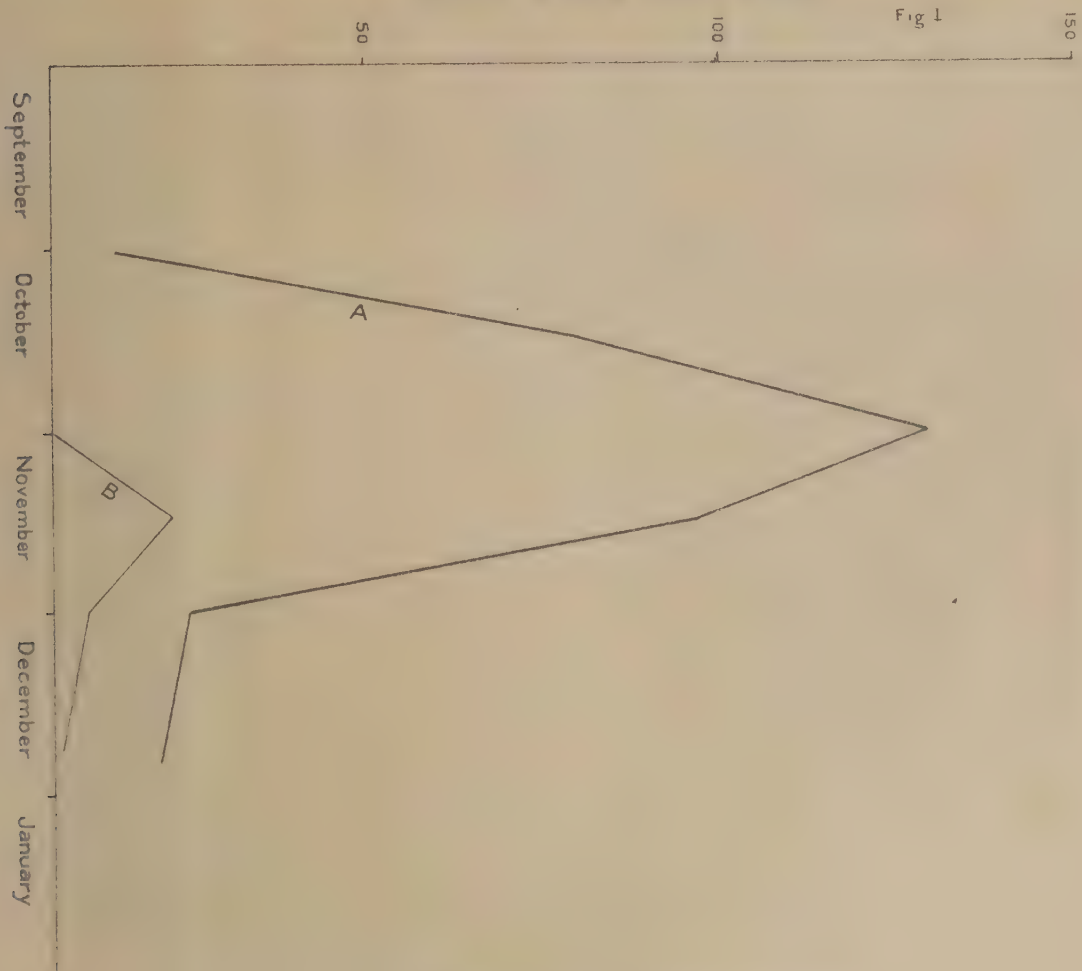
On 4th October 220 infected plants were labelled and observations were made of these at intervals, counting the number of leaves infected and the number of individual stem infections in an active state.

On 3rd November 100 plants recently infected were labelled and similar counts made on them through the season.

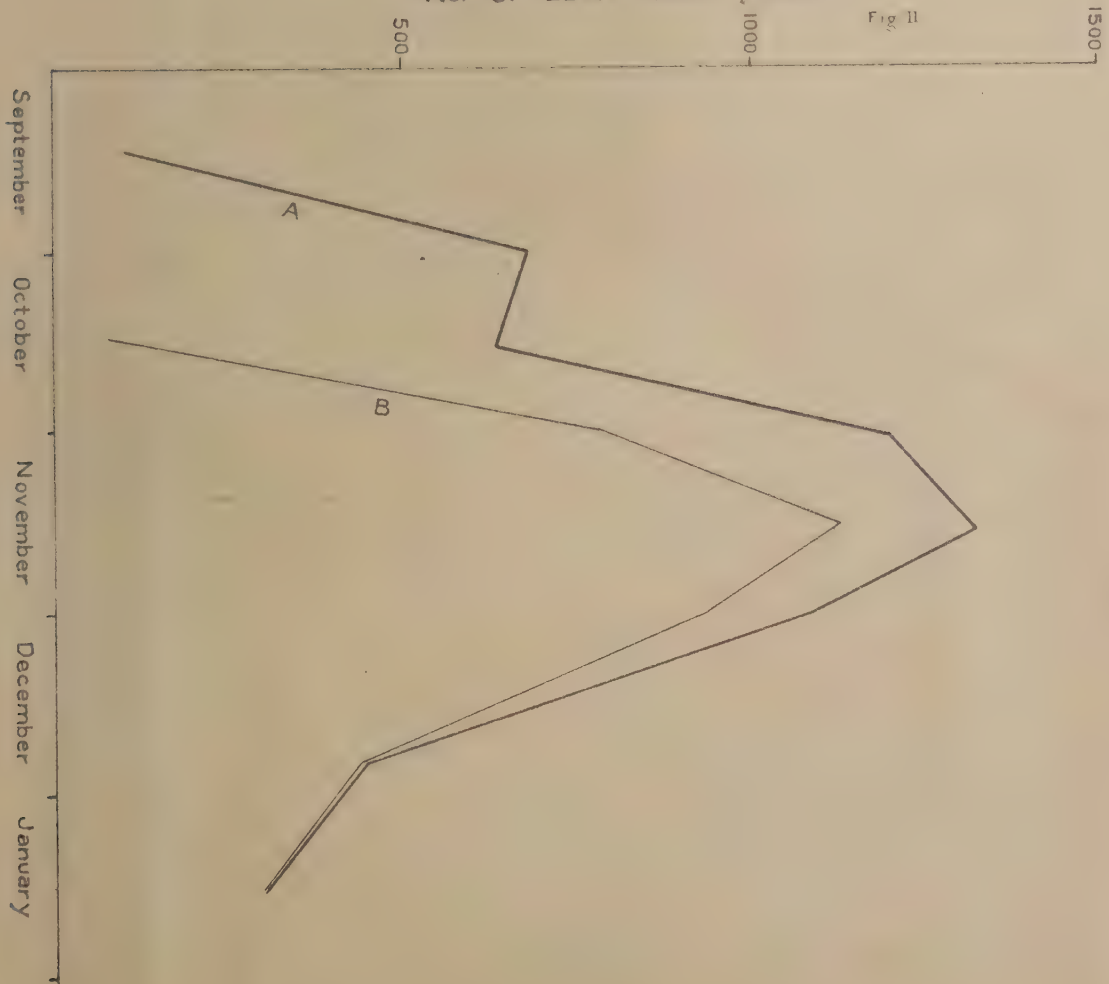
Fig. I shows in Curve "A" the number of active stem infections present on the 220 plants selected in October ; while Curve "B" shows the infections on the 100 November plants, this curve being multiplied by 2.2 for comparison with Curve "A."

Fig. II shows the history of the disease on the leaves of the same plants as Fig. I.

No. OF STEM INFECTIONS



No. OF LEAF INFECTIONS



METEOROLOGICAL RECORDS IN OBSERVATION COTTON PLOT, KAMPALA, 1930-31.

Week ending	AIR TEMPERATURES.					RELATIVE HUMIDITY %.			SOIL TEMPERATURES.				Total Sun hours.	Total Rain inches.	No. of Rainy Days.	
	Highest Max.	Lowest Min.	Average Max.	Average Min.	Average day.	Average night.	Driest day.	Wettest day.	Average day.	Highest.	Lowest.	Average Max.				Average Min.
August	82	57	78	59	69	61	79	86	82	75	63	72	65	26	2.72	4
"	80	55	79	59	72	63	64	80	72	78	65	76	67	47	0.06	1
"	85	58	82	60	74	62	64	80	72	85	68	81	70	55	0.06	2
"	85	55	82	58	75	61	54	88	66	87	69	84	71	61	0.26	1
"	83	57	79	59	73	62	54	85	68	86	66	80	69	37	1.04	2
"	81	58	78	59	72	61	72	79	76	78	66	75	67	25	0.33	4
September	89	58	84	60	76	63	63	76	72	85	68	81	69	55	1.75	3
"	89	58	84	60	76	63	63	76	72	85	68	81	69	55	1.75	3
"	83	57	77	57	70	62	71	90	82	...	...	...	...	28	5.22	5
"	83	57	77	57	70	62	71	90	82	...	...	...	...	28	5.22	5
"	85	59	81	62	74	64	67	75	71	85	70	81	71	46	0.26	2
"	86	57	81	59	73	63	66	83	73	84	70	81	71	40	0.76	4
October	...	...	83	60	...	...	...	...	...	82	68	79	71	36	0.69	5
"	88	60	83	61	73	62	65	88	73	87	70	83	73	40	2.35	4
"	84	58	82	61	73	64	69	80	74	82	70	78	71	44	0.44	2
"	83	58	81	60	72	63	69	84	76	79	68	78	70	41	0.54	2
November	85	59	83	61	76	64	64	78	71	85	70	82	73	54	0.74	1
"	86	61	85	63	78	65	55	74	66	87	76	86	77	56	0.08	2
"	88	59	80	61	72	64	64	89	80	88	69	79	71	36	1.85	7
"	...	...	83	60	...	...	...	...	...	77	69	76	70	45	0.19	1
"	84	56	79	59	71	63	72	89	78	79	68	76	70	31	0.69	4
December	87	56	83	60	76	63	60	83	70	81	69	79	72	57	0.72	2
"	88	56	84	59	77	63	59	75	68	84	70	81	72	49	0.16	1
"	91	58	89	59	79	63	53	63	58	88	74	86	76	60	...	...
"	91	55	87	57	78	62	53	68	62	88	75	86	77	56	...	...
January	82	56	78	59	71	62	68	93	79	83	68	77	70	32	2.59	4
"	88	55	84	59	76	62	65	83	68	83	70	81	72	60	0.35	1
"	90	57	85	61	77	65	63	78	70	84	71	82	73	53	0.37	1
"	90	58	86	61	78	65	59	87	69	86	70	82	74	61	0.33	2

TOTAL RAIN 24.55 INCHES.

ANNUAL REPORT OF THE AGRICULTURAL CHEMIST.

GENERAL.

1. I left the country on leave on March 27th and returned on November 3rd. The journey was broken at Tanga to visit the East African Agricultural Research Institute in order to get into personal touch with the staff there, and to discuss methods of co-operation.

During my leave I attended two Conferences:—

(a) Empire Cotton Growing Corporation at Didsbury, August 27th and 28th.

(b) Imperial Bureau of Soil Science at Rothamsted, September 16th to 18th.

Reports of these Conferences have already been published.

I also visited the Research Station of Messrs. The Imperial Chemical Industries, Limited, at Jealott's Hill, and the head offices of Messrs. The Dominions Potash Supply Company, to discuss plans for fertiliser trials and arrange for a supply of the necessary fertilisers. The thanks of the Department are due to these Companies for a free supply of all the fertilisers used.

Dr. G. Griffith, Assistant Agricultural Chemist, arrived on first appointment on October 21st.

COFFEE MANURIAL TRIALS.

2. A number of trials on the effects of various fertilisers on coffee have now been started, thanks to the co-operation of several planters.

In the Toro area the following treatments are being tried on each of five plantations:—

A. Diammonphos	...	180 lbs. per acre.	E. Sulphate of Potash	...	2 cwts. per acre.
B. Superphosphate	...	2 cwts. „ „	Superphosphate	...	2 „ „ „
C. Sulphate of Potash	...	2 „ „ „	F. No treatment.		
D. Sulphate of Potash	...	2 „ „ „			
Diammonphos	...	180 lbs. „ „			

The experiment is planned as a six by six Latin square. The plots are 0.05 acre containing between thirty and forty trees per plot according to the planting distance.

The fertilisers were applied towards the end of the rains in June when the season's crop had already set, so that the fertilisers could not be expected to have any immediate effect. Two estates returned nil yields and the yields of the other three are given below in cwts. of cherry per acre.

RUBONA ESTATE (*F. D. West, Esq.*).—

Treatment.										
	A	B	C	D	E	F	Mean	S.E.M.D.	Significant Difference.	
Yield:—	13.12 ...	12.60 ...	12.76 ...	11.12 ...	9.16 ...	9.24 ...	11.36 ...	2.48 ...	5.4	
Percentage of Mean:—	115.7 ...	111.1 ...	112.7 ...	98.0 ...	78.9 ...	81.5 ...	100.0 ...	21.77 ...	47.5	

KAHANGI ESTATE (*A. S. Watkins, Esq.*).—

Treatment.										
	A	B	C	D	E	F	Mean	S.E.M.D.	Significant Difference.	
Yield:—	16.18 ...	16.10 ...	13.48 ...	16.96 ...	15.83 ...	16.75 ...	15.89 ...	3.8 ...	8.51	
Percentage of Mean:—	101.86 ...	101.35 ...	84.86 ...	106.7 ...	99.65 ...	105.5 ...	100.0 ...	24.06 ...	53.5	

NYAKABALE ESTATE (*T. N. Dalziel, Esq.*).—

Treatment.										
	A	B	C	D	E	F	Mean	S.E.M.D.	Significant Difference.	
Yield:—	7.59 ...	7.92 ...	7.93 ...	7.31 ...	7.43 ...	8.10 ...	7.71 ...	0.67 ...	1.48	
Percentage of Mean:—	98.5 ...	102.8 ...	102.9 ...	94.8 ...	96.4 ...	105.4 ...	100.0 ...	8.7 ...	19.2	

In the Northern Province experiments have been started on two plantations:—

(1) KYATURUGO (*T. P. Margach, Esq.*).—

A. Simsim meal	...	4 tons.	D. Control.
B. Cotton seed	...	4 "	E. Kynoch Coffee Compound ... 400 lbs.
C. Elephant grass mulch.			

Yield nil.

(2) HOIMA RIVER (*D. N. Stafford, Esq.*).—

Eight by eight Latin square; plots 0.05 acre:—

A. Sulphate of Potash	...	2 cwts.	E. Superphosphate	...	2 cwts.
B. Superphosphate	...	2 "	Sulphate of Potash	...	2 "
C. No treatment.			F. Diammonphos	...	180 lbs.
D. Diammonphos	...	180 lbs.	G. Cotton seed	...	3 tons
Sulphate of Potash	...	2 cwts.	H. Elephant grass mulch,	12 ins.	

Yield nil.

On all these estates soil samples were collected before the fertilisers were applied and will be taken every alternate year. These will be analysed to endeavour to find, in the course of time, if there is any correlation between the analyses of the various soil types and their response to fertilisers. The work will be extended to other districts if possible.

When these experiments were laid down it was thought that, although coffee is grown from seed and therefore there is a natural individual variation in yield, by having a large number of trees per plot this variation, together with the soil heterogeneity, could be eliminated in the analysis of variance.

Since then, however, T. N. Hoblyn,* of the Imperial Bureau of Fruit Production, has pointed out that there is some doubt as to whether coffee arabica is homozygous, and suggests the advisability of collecting individual tree yields for a number of years before embarking on manurial experiments.

It is obviously impossible to carry this out on a co-operative basis here because the labour is not sufficiently reliable, and in any case the work would have to be done at the planters' busiest time, *i.e.*, that of picking and preparing the crop. It is therefore proposed to continue the experiments over a period of years as originally laid down, and, in addition, to start collecting individual tree records from younger coffee on the Government Plantations.

CROP RESIDUE EXPERIMENT.

3. With a view to obtaining some data on the most advantageous crop to precede cotton in a rotation this experiment was laid down in the season 1927-1928 on the Kampala and Bukalasa Plantations.

Taking cotton as the main economic crop it is desirable to arrange, if possible, to precede it with a food crop which does nothing to depress the yield of cotton.

To simplify the problem all questions of green manuring and fertilisation are left out. The plan is a five by five Latin square in which maize, groundnuts, beans, sim-sim and sweet potatoes are planted each year in their respective plots in the spring rains, followed by cotton (usually sown in July). In the course of time the exhaustive effects of each food crop should be reflected in the yield of cotton.

The results to date are given below:—

KAMPALA PLANTATION.

Season		Treatment	Sim-sim	Maize	Beans	Ground-nuts	Sweet Potatoes	Mean	S.E.M.D.	Significant difference
1927-28	...	Mean Yield per acre in lbs.	185.6	118.0	163.6	135.4	...	149.0	50.00	115.6
		Percentage of Mean	124.6	79.3	109.4	90.7	...	100.0	33.50	77.6
1928-29	...	Mean Yield per acre in lbs.	565.0	542.0	629.0	515.0	601.0	570.0	40.00	92.3
		Percentage of Mean	95.1	90.4	99.1	110.0	105.4	100.0	7.02	16.2
1929-30	...	Mean Yield per acre in lbs.	182.0	244.5	271.0	312.0	205.0	242.9	41.50	95.7
		Percentage of Mean	75.0	100.6	125.0	128.6	84.5	100.0	17.10	39.4
1930-31	...	Mean Yield per acre in lbs.	156.0	178.0	208.0	217.0	212.0	194.0	23.20	53.6
		Percentage of Mean	80.5	91.8	107.0	112.0	109.4	100.0	11.96	27.6

* Field experiments in horticulture.—T. N. Hoblyn, Imperial Bureau of Fruit Production, Technical Communication No. 2, March, 1931.

The only significant differences by the "Z" test are shown in the last two seasons in which sim-sim is definitely worse than groundnuts in 1929-30 and worse than both groundnuts and sweet potatoes in 1930-31.

BUKALASA.

Season	Treatment	Sim-sim	Maize	Beans	Ground-nuts	Sweet Potatoes	Mean	S.E.M.D.	Significant difference
1927-28	... Mean Yield per acre in lbs.	536.0	544.0	580.0	480.0	...	535.0	64.60	149.00
	Percentage of Mean ...	100.2	101.7	108.5	89.8	...	100.0	12.80	27.05
1928-29	... Mean Yield per acre in lbs.	306.0	304.8	290.8	290.8	332.0	304.9	24.26	56.00
	Percentage of Mean ...	100.4	99.9	95.5	95.5	109.0	100.0	7.96	18.38
1929-30	... Mean Yield per acre in lbs.	66.8	76.0	52.0	67.6	52.0	62.88	10.44	24.20
	Percentage of Mean ...	106.2	120.8	82.8	107.5	82.8	100.00	16.62	38.50
1930-31	... Mean Yield per acre in lbs.	320.0	256.0	284.0	312.0	432.0	320.8	33.80	68.00
	Percentage of Mean ...	99.8	79.8	88.5	97.3	134.6	100.0	10.54	21.20

The only significant result of note is the overwhelming superiority of sweet potatoes over all other crops in season 1930-31.

LIME AND GREEN MANURE TRIAL, BUKALASA.

4. In view of the fact that the soils of this country are usually lacking in organic matter and lime, a trial was started at Bukalasa to test the effects of:—

- (A) Lime only,
- (B) Lime and Green Manure,

on cotton yields.

A similar trial was conducted at a private estate on coffee from 1925 to 1927. In this case the soil showed a lime requirement of two tons per acre, lime was therefore applied at rates of one ton and two tons, but the crop did not respond in either case. The results of the Bukalasa trial are:—

Season.	Treatment.	Lime only.	Lime and Green Manure.	None.	Mean.	S.E.M.D.	Significant difference.
1927-28	... Mean Yield in lbs. per acre ...	503.4	523.4	533.4	520.0	36.4	80.00
	Percentage of Mean ...	96.8	100.7	102.7	100.0	7.0	15.40
1928-29	... Mean Yield in lbs. per acre ...	466.4	411.4	529.4	469.0	88.40	197.00
	Percentage of Mean ...	99.5	87.7	113.0	100.0	18.85	42.00
1929-30	... Mean Yield in lbs. per acre ...	180.0	230.0	232.0	214.0	55.80	124.00
	Percentage of Mean ...	84.1	107.5	108.4	100.0	26.10	58.00
1930-31	... Mean Yield in lbs. per acre ...	603.2	690.0	673.4	655.6	46.40	103.40
	Percentage of Mean ...	92.0	105.3	102.7	100.0	7.10	15.78

Although none of these results are significant it will be seen that in each season the no treatment plots have consistently given higher yields than the mean.

SOIL EROSION EXPERIMENT, SERERE.

5. The present system of native agriculture through the major portion of the Protectorate is one of shifting cultivation. The peasant opens up a plot of land often on considerable slopes, crops it for two or three years and then proceeds to open up fresh land elsewhere. He knows by experience that it will not pay him to work on the old plot any longer and it is allowed to revert to bush. The first weed to appear in the old plot is lumbugu (*Digitaria abyssinica*) which in course of time gives way to elephant grass (in tall grass country). In any case it would not be profitable to open up the old land again for fifteen or twenty years.

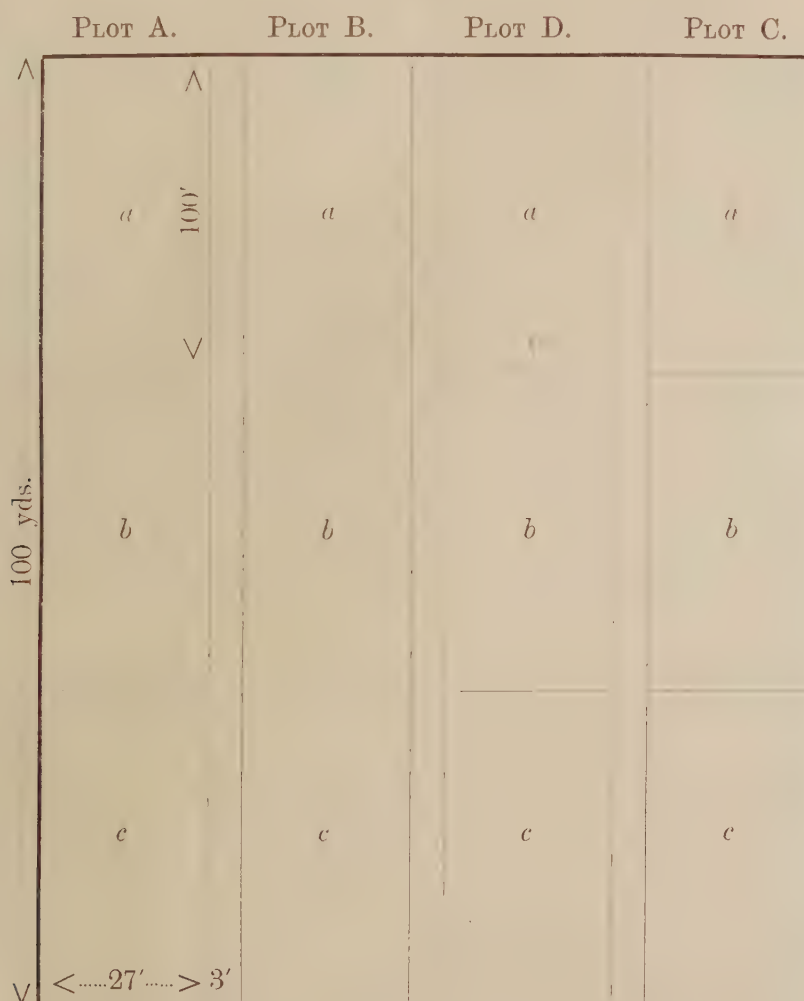
One of the principal factors in the loss of fertility of these plots is erosion, by which, even if the top soil is not removed *en bloc*, the finer soil fractions (clay and humus) are washed out and these are the fractions containing the plant food. It is obvious that such a system of cultivation must lead to a general decrease in fertility in the country as a whole, and to a decrease in forest area. Before, however, this system

can be changed to one of permanent small holdings, data must be collected as to (a) the best rotation which could be adopted to keep up the soil fertility, and (b) the best erosion check applicable to native agriculture with annual crops. The first problem is being tackled through rotation experiments laid down by various officers of the Department on the Government Plantations, of which the crop residue experiment is one.

The second problem does not exist in the case of land under permanent crops, such as coffee or plantains, because mulching with elephant grass or with plantain residue has been found to be quite effective. To obtain data from land under annual crops, an experiment has been laid down at Serere and will shortly be laid down at Bukalasa.

This is in the form of four randomised blocks, and the three erosion checks tried are (a) Kapenda contour hedge, (b) lemon grass contour hedge, (c) surface contour drains. The fourth plot in each block has no treatment. Each plot is a strip 9 yds. by 100 yds. with the long side down the slope, and the treatments are applied according to this plan of one of the blocks.

Block 1.



The drains between the plots are strongly revetted to prevent widening. The yields from the *a*, *b* and *c* portions of each will be kept separate and every alternate year soil samples from each subplot will be taken for mechanical analysis and organic matter determinations.

- A. Kapenda (*Cajanus Indicus*) contour hedge.
- B. No treatment.
- C. Surface drain.
- D. Lemon grass contour hedge.

W. S. MARTIN,
Agricultural Chemist.

ANNUAL REPORT OF THE ECONOMIC BOTANIST.

Mr. L. C. C. Liebenberg was in charge of the botanical work until the middle of June, when he proceeded on leave. I took over the duties from that date and remained in charge until the end of the year.

2. It was necessary to visit the Botanical Gardens, Entebbe, at frequent intervals, as there was no Plantation Manager available to take charge of them and they were left mainly in the hands of the Clerk, Mr. Menezes. The raising and propagation of the more rare and delicate species of plants for essential oils also required a lot of personal attention, the officer in charge of the Kampala Plantation being unable to deal with this, as he was occupied with educational work for the major portion of his time.

COFFEE.

3. *Selection*.—A large number of the *Coffea robusta* trees originally selected by Mr. Liebenberg were carefully inspected. Many of them were found to be unsuitable for retention as they had deteriorated and had not maintained their good cropping qualities, resistance to drought, or immunity from disease.

The best of them, however, were retained, and a number of new selections were made. Altogether forty-seven trees were selected within a radius of fifty miles from Kampala, and this number was considered sufficient for present purposes, though others may be added as they are met with in the course of ordinary duties. The coffee from these trees is being picked separately and will be sent to the Imperial Institute for examination and report on roasting and liquoring qualities. The final selection will not be made until these reports have been received and reliable data obtained as to yield together with size and uniformity of the beans.

4. A few *Coffea arabica* were also selected but with this species considerable difficulty has been met with owing to the fact that *Arabica* is no longer cultivated on many plantations around Kampala, or is found only as a catch-crop among *Hevea* rubber and not receiving the same careful attention as formerly. Hence there is not much good material to select from and up to the end of the year only sixteen selections had been made. In connection with this work it will be necessary to visit more outlying districts when this can be arranged.

5. *Hybridization*.—In view of the unsatisfactory results which have so far been obtained in this branch of the work it has been decided to discontinue it for the present.

The few hybrids which have been raised from seed of trees which have been specially cross-fertilized, have been planted out and are being kept under observation. Plants originating from seed of the older hybrids, raised by Mr. Maitland, have also been planted out to test whether any better yielding types may result from the natural crosses between these hybrids and other trees. The original hybrids themselves, though strong growing and disease-resistant, give very poor crops and the coffee is practically all "pea-berry," only one bean being produced in each fruit.

6. *Vegetative Propagation*.—Attention has been largely concentrated on this branch of the work, with a view to the propagation of a few of the most desirable of the selected types and eventually obtaining a sufficiently large stock (which would be planted at a suitable distance from any other coffee) to ensure self-pollination and thus produce a reliable seed supply for distribution for planting.

7. As previous efforts in this direction had not met with much success and had not resulted in any grafted plants being established on the Plantation (apart from the few originally grafted by Mr. Maitland some ten years or so ago) it was necessary to make a fresh start. It was decided to adopt the system of "cleft" or "split" grafting, following the methods used in Java, where it has been successfully employed.

8. The first experiments were commenced in July, using as stocks upright shoots cut off the trees and placed in water immediately afterwards. The water was changed daily, but no nutrient added. It was found possible to keep many of these shoots alive until union had taken place, and in some cases until the buds of the scion had grown out and developed young leaves. These experiments showed that it was advisable to remove the ties from the grafts about 21 days after grafting, otherwise they became too tight and cut into the stock. Test-tubes were placed over the grafts and it was found that the scion often kept alive for two weeks without union taking place. The most critical period was during the third week and scions which survived for 21 days were usually successfully united. It was also noted that if the test-tubes were removed from the grafts before they had become properly united, the scions immediately shrivelled up and died. They are best left on until the buds of the scion grow out and touch the sides of the tubes.

9. The first experiments of grafting young plants was on the 26th July, when eleven *Robusta* and five *Arabica* scions were grafted on *Excelsa* and *Liberica* stocks.

The stocks were in banana-fibre pots and the plants were kept on the verandah of the Laboratory after grafting. In this first trial no special scions were used but the results were so satisfactory that scions from selected trees were used in all later experiments. *Robusta* stocks were used, in addition to the two above mentioned, and all proved equally serviceable for the purpose provided they were sufficiently large in diameter for the scions. Owing largely to the difficulty of obtaining stocks sufficiently large, the actual number of plants grafted before the end of the year was small. Details are given below:—

Date.		Number Grafted.	Number Surviving.						Number successfully planted out.		
			One month.				Two months.				
			Total.		%	Total.		%	Total.	%	
26- 7-30	...	16	15	...	93·75	12	...	75	11	...	68·75
12- 8-30	...	10	7	...	70	7	...	70	6	...	60
30-10-30	...	12	10	...	83·33	10	...	83·33	Dry season		
12-11-30	...	14	8	...	57·14	7	...	50	"	"	
17-12-30	...	10	6	...	60	5	...	50	..	..	

Owing to the dry season setting in, it was not possible to plant out those plants grafted from October onwards, but these will be planted out during the March rains.

10. In the course of the experiments with grafts grown in water, both clear test-tubes and those painted white were used and it appeared that more success had been obtained with the latter. It was decided to test this when grafting plants. The results, however, which are given below, have not confirmed this up to the present.

Date.		Clear Tubes.	Painted Tubes.	Surviving two months or more.	
				Clear Tubes.	Painted Tubes.
				%	%
12- 8-30	...	7	3	4 or 57·14	3 or 100
30-10-30	...	6	6	6 " 100	4 " 66·66
12-11-30	...	7	7	4 " 57·14	3 " 42·87
17-12-30	...	5	5	3 " 60	2 " 40

11. Careful observations were taken and recorded which showed that though the actual grafting operation was not exceptionally difficult there were various factors which had an important bearing on the success of the grafts. Though it has not been possible to test these out by special experiment, it may be useful to record them below as my own personal experience, in case they may be of interest to others engaged in similar work.

(a) The stock and the scion should be of practically the same thickness at the points which are united.

(b) The state of the wood or the season at which the scions are taken may influence the results. If too hard and dry they are difficult to cut and do not readily unite. On the other hand, soft sappy wood, or such as follows renewed growth after heavy rains, is not advisable, as it shrinks too quickly.

The growth from trees which have just borne a heavy crop are often unsuitable, as is also the case with wood subjected to a long dry spell. It will be seen from the figures in paragraph 10 that the percentage of successes was decidedly smaller as the dry season advanced.

(c) The length of stem left above the node of the scion should not generally exceed one or two inches. If too much is left, the test-tube is kept too high and in any case no growth will be produced from the internode. Scions with two short nodes can be used but are not generally recommended.

(d) The point of grafting should be situated as near as possible to the middle of the test-tube when the latter is inserted over it. If too near the mouth of the test-tube the graft is not kept sufficiently moist and may dry out before union is effected.

(e) The test-tube is best kept clear of the ground. If the height of the grafted plant is not sufficient to ensure this, then the tube can be made to rest in the slit end of one or two small sticks. This will also steady the tube and keep it from being swayed by the wind.

(f) Better success has been obtained from stock-wood which is "brown" at the point of grafting rather than "green." In the latter there is not the same natural tendency for the split in the stock to spring together again and hold the scion tight, while the young buds are apt to attract the sap away from the scion.

(g) When cutting the leaves off the scion care must be taken not to injure the buds in the leaf-axils at the same time. Also scions whose buds are damaged or dried up should not be used as they are likely to remain blind and not grow out, even though union with the stock may be effected.

(h) The scion wood should be quite sound. Any superficial fungous disease is apt to develop rapidly in the moist air enclosed in the test-tube and results in rapid blackening of the scion and subsequent failure.

12. After the test-tubes were taken off the grafts, the plants were removed first to a garden-frame, where they were shaded and the air kept moist for a week or two before being taken to the nurseries for gradual hardening off prior to planting out in their permanent position. A glass-roofed plant shed, on the lines of the one in use in Java, was erected during December for housing the plants during grafting and for a short time before and after the operation. This should greatly facilitate future work.

13. Propagation by cuttings, either for the direct increase of good trees or for the provision of stocks for grafting, was tried only on a small scale by Mr. Liebenberg. Only one or two cuttings took root but it is proposed to investigate this method more fully during the ensuing year.

14. *Self-pollination.*—In order to test the effects of self-pollination on the production of seed, grafted plants of two selections have been planted in isolated positions on the Kampala Plantation, where in due course they may be suitably protected from cross-pollination and early and reliable information obtained for future guidance.

15. *Selected Seed for Distribution.*—The oldest of the trees on the Kampala Plantation, which have been raised from the original Selection No. 9, have been carefully examined and few of the worst trees have been cut out, leaving only those which produce the largest beans and the best crops. The coffee from these trees will be used for seed purposes until a more reliable supply has been worked up by vegetative propagation.

RUBBER.

16. *Tapping Yields.*—The tapping of the nineteen best yielding trees on the Kampala Plantation was continued until the end of July, when it was decided to stop tapping in view of the fact that sufficient data had been obtained to determine the highest yielding trees and that the price of rubber had fallen so low. The best tree yielded an average of 25.7 ounces of dry rubber per month over a period of 43 months; the worst tree an average of 11.8 ounces per month over a period of 31 months. Only three trees yielded one pound of dry rubber or over per month, namely, 19/96, 20/49 and

100. Five trees yielded less than an average of 12 ounces per month. The monthly records for the year, together with the totals of previous years and the grand total, are attached.

17. *Budding*.—It was not possible to do much budding during the year as the trees originally pollarded produced only a small quantity of weak growth. The best of the bud-wood available was selected from four trees on the Kampala Plantation and two trees from Entebbe Gardens at the end of September. Thirteen trees were budded with the Kampala material, of which three were successful and have made good growth. These three were all from one bud-stick, every bud of which succeeded. Twenty-two trees were budded with the material from Entebbe Gardens but only three were successful. The method used was similar to that generally employed in the East, except that the quality of the bud-wood being poor it did not permit of the bud patches being cut so wide as is generally recommended. The results indicate that given good bud-wood there should be no great difficulty in budding rubber in this country after a little more experience has been gained. The selected trees have been pollarded more severely to induce better growths for future experiments.

18. *Brown Bast Experiment*.—After consultation with the Mycologist it was decided to discontinue this experiment, as it was thought that rubber research workers in the East were in a much better position to deal with this question, and that it would be more profitable for us to confine ourselves to trying out the remedies which these scientists suggested for combating or alleviating the disease, when they are in a position to recommend any which have met with success.

ESSENTIAL OIL PLANTS.

19. The introduction, raising and propagation of plants for the production of essential oils was continued. Owing to the absence of the Chemist on leave, and the experiment still not having been set up until his return, it was not possible to carry out any tests during the year. At the time of writing, however, the still has been set up and a few initial experiments have been carried out.

20. The following exotics are now established on the Kampala Plantation in quantity sufficient to provide material for distillation experiments and also for distribution for propagation and planting by those planters who are interested in this industry :—

<i>Cymbopogon citratus</i> (Stapf.)	...	...	...	Lemon Grass.
<i>Vetiveria zizanioides</i> (Stapf.)	...	...	...	Vetiver.
<i>Pogostemon Patchouly</i> (Pellet)	...	...	...	Patchouli.
<i>Plumeria acutifolia</i> (Poir)	...	...	...	Frangipani.
<i>Poltianthes tuberosa</i> (L.)	...	...	...	Tuberose.
<i>Pelargonium capitatum</i> (Ait. var.)	...	...	...	Geranium.
<i>Mentha viridis</i> (L. var.)	...	...	...	Scented Mint.

21. Exotics which were established in the nurseries up to the end of the year are given below. These will be ready for planting out in plots during the March rains in 1931.

<i>Acacia</i> sp.—Mimosa. 180 young trees in nursery beds.
<i>Cyclamen persicum</i> (Sibth. et Sm.)—Cyclamen. 190 plants in pots.
<i>Lavendula vera</i> (DC).—Lavender. 10 plants in nursery beds.
<i>L. Spica</i> (Cav.)—Spike Lavender. 201 plants in nursery beds.
<i>Lippia citriodora</i> (H. B. et K.)—Lemon-scented Verbena. 38 plants in nursery beds.
<i>Pelargonium odoratissimum</i> (Ait.)—Nutmeg Geranium. Five plants producing seed.
<i>P. sp.</i> var. Attar of Roses.—Rose-scented Geranium. Two plants in nursery beds.
<i>Thymus</i> sp.—Scented Thyme. 60 plants in nursery beds.
<i>Reseda odorata</i> (L.)—Mignonette. Two boxes producing seed.

22. Plots of various indigenous aromatic plants are also established on Kampala Plantation ready for distillation trials when convenient. The majority of them belong to *Labiatae* and the most promising are given below, together with their Luganda names :—

<i>Blumea lacera</i> (DC.)	...	...	...	"Kulya."
<i>Coleus barbatus</i> (Benth.)	...	...	...	"Kyawamala."
<i>Coleus</i> sp.	...	...	...	"Kawamala."
<i>Coleus</i> sp.	...	...	...	"Mubiri."
<i>Hoslundia opposita</i> (Vahl.)	...	...	...	"Kamunye."
<i>Mentha aquatica</i> (L.)	...	...	...	"Kagogo."
<i>Ocimum menthaefolium</i> (Hochst.)	...	...	...	"Kakubansiri."
<i>Ocimum</i> sp.	...	...	...	"Mujaja omunene."

23. Part of the plot of Vetiver, planted in April, 1930, was dug up in November and yielded at the rate of 772 lbs. of dried roots per acre. The soil was rather poor and inclined to dry out rather quickly. As Vetiver prefers a rich, moist soil, fresh plots were planted near the swamp and these are expected to give better returns. A small consignment of the dry roots was sent to the Imperial Institute for report. The plants in the remainder of the plot were left, in order to note whether there was much increase in the yield of dry roots when the plants are left for a longer period.

FIXED OILS.

24. *Oil Palm (Elaeis guineensis Jacq.)*.—The mature palms in the Entebbe Gardens, which were originally much too closely planted, were thinned out to approximately 30 ft. by 20 ft., their number being reduced from 243 to 138. Individual records of these palms are being kept in order to determine which produce the best crop, as well as to provide information as to the results which are likely to be obtained, from the cultivation of this palm in Uganda. All the palms were trimmed up and all old leaves and diseased fruits which had lodged in the leaf-axils were removed. A large number of seedlings have been raised for the purpose of planting one or two trial plots in suitable parts of the Protectorate.

25. *Tung Oil (Aleurites spp.)*.—The germination of the seed received from the Amani Institute in 1929 proved very disappointing. Seeds were distributed to various departmental experiment stations, and also to the Forestry Department, but in most cases only a few odd seedlings were raised. At Kampala Plantation nine *Aleurites Fordii* and one *Aleurites montana* were planted out. These are now from two to three feet high, making good growth, and should become well established during the next year. A further supply of seed has been ordered.

26. *Hydnocarpus*.—Small plots of *Hydnocarpus anthelmintica* and *H. Wightiana* are now well established, both at Entebbe Gardens and Kampala Plantation. The latter flowered towards the end of the year and set fruits, but these had not ripened at the end of December. There is every reason to expect that these two species will succeed very well in Uganda.

GREEN MANURE AND COVER CROPS.

27. A large number of species of leguminous plants, both indigenous and exotic, are now being grown on the various departmental experiment stations. They may be divided into two groups, namely: (1) the *Phaseoleae* type, which either trails along the ground or climbs over other plants; and (2) the *Genisteae* or *Galegeae* erect form. The plants belonging to the former group are more suitable as cover crops, to check soil-erosion, keep the ground cool and increase the humus content, while those of the latter group are better adapted as green manures, either for cutting and mulching on the ground or for digging into the soil. Though the plants of the former group are inclined to climb coffee trees and others which have rather thin stems, by reasonable attention the trees can be kept free from the injurious growth and the increased fertility of the soil well justifies the little extra labour entailed, which is also usually counter-balanced by a decrease in the cost of weeding. The following lists give the names of the more important and most promising species together with notes on their origin.

(1) PHASEOLEAE TYPE.—

Centrosema pubescens (Benth.) and *C. Plumieri* (Benth.)—Natives of South America but introduced into Uganda from the Malay States. Probably the most useful of the introduced species.

Dolichos Lablab (L.)—Indigenous. Quite useful strong growing species.

D. Hosei (Craib.)—Introduced from Ceylon. Not such a strong grower as the above.

D. biflorus (L.; var.)—This variety was recently introduced from Ceylon but the species is indigenous to Uganda.

Calapogonium mucunoides (DC.)—From the Malay States. Makes a useful ground cover.

Phaseolus calcaratus (Roxb.)—From Ceylon. Very similar to the above in growth.

Mucuna pruriens (DC.)—An indigenous quick growing annual.

Desmodium adscendens (DC.)—An indigenous perennial often found under shade of Hevea rubber trees.

(2) GENISTEAE OR GALEGEAE TYPE.

Crotolaria striata (DC.)—An indigenous quick growing shrub, and one of the oldest and best known green manure plants.

C. juncea (L.)—Sunn-Hemp. An erect shrub from Tropical Asia. Also grown for fibre.

C. intermedia (Kotschy).—Indigenous shrub, produces less growth than *C. striata*.

C. natalitia (Meissn.)—Indigenous. Similar growth to *C. intermedia* but leaflets shorter and rarely exceeding one inch long.

C. atata (Ham.)—Native of India; small shrub 1—2 feet high. Useful if sown thickly.

Tephrosia Vogellii (Hook f.)—An indigenous shrub up to 6 feet or more. Also useful as temporary shade or shelter crop.

T. atro-violacea (Bak. f.)—An indigenous compact shrub, 2—3 feet high, very similar to *Tephrosia purpurea*.

Indigofera anil (L.)—An indigenous freely branching shrub 2—4 feet high.

I. endecaphylla (Jacq.)—An indigenous shrub 1—3 feet high, a variety of which has been introduced from Ceylon.

FIBRES.

28. Attention is being directed to the possibilities of some of the indigenous fibre producing plants, and stocks of some of the most promising are being raised so that experimental plots may be planted. These include various species of Hibiscus and also *Asclepias semilunata* (N.E.Br.). A small plot of Ramie Fibre has also been planted while experiments with *Crotolaria juncea* (L.) are being carried out at Bukalasa.

FRUIT AND MISCELLANEOUS ECONOMIC TREES.

29. Most of the introduced citrus trees, referred to in the Annual Report for 1929, have now become established at Kampala and Entebbe. A few of them have already yielded several fruits. It has not yet been possible to carry out any budding of common citrus stocks with material from the imported trees. Five mangoes were successfully grafted by the approach method and were planted out. The grafting of these was carried out by Mr. Liebenberg.

30. Six plants of Persimmon (*Diospyros Kaki*, L.) from South Africa are now well established at Kampala. These include three named varieties:—The Durian (*Durio zibethinus*, Murr.), Litchi (*Nephelium Litchi*, Cambess), and the Rambutan (*Nephelium lappaceum*, L.) seedlings, however, all died off after being planted out several months. A large number of *Dillenia indica* (L.) were raised, some of these being planted out at Kampala and the others were distributed. Seedlings of the Mangosteen (*Garcinia mangostana*, L.) and the Sapodilla Plum (*Achras Sapota*, L.) were also raised, but are not yet ready for planting. The former grow very slowly.

31. The plot which was planted in the north-east corner of the Kampala Plantation in April, 1921, and contains about twenty kinds of useful fruit and economic trees, and which had been somewhat neglected, was cleaned up and *Centrosema pubescens* (Benth.) was sown between the trees as a cover crop. Many of these trees are now fruiting and providing useful supplies of seed.

SPICES AND CONDIMENTS.

32. As several enquiries were received respecting vanilla cultivation, the plot at Kampala was cleaned up and a number of new plants put in. Owing to the advent of dry weather before the shade had sufficiently developed these plants have not done so well as was expected. This crop is doing well on a plantation at Entebbe belonging to an Indian, and good crops of pods are being obtained. Seeds of several species of condiments were received during the last few days of the year and will be dealt with in 1931. Seeds of other species are on order.

GRAZING AND FODDER GRASSES.

33. Owing to the pressure of other work it was not possible to do much in this direction, but in November and December, 15 one-hundreth-of-an-acre plots were planted with promising species of indigenous grasses obtained near Kampala and Entebbe. To these will be added species from other districts as opportunity permits. These small "nursery" plots will be used for preliminary observations and investigations, while they will also be useful for the supply of seed and plants, for which applications are received from time to time. Larger plots of the most important species are being laid down at Bukalasa Plantation, where feeding and grazing trials will be made.

HERBARIUM.

34. Several hundred sheets of specimens collected by the Botanist, or sent in to him for naming, were laid in during the year. 554 sheets from my own private collections were also added. The collection, however, is still very incomplete, except with regard to the *Gramineæ*, which is now well represented. Most of the work in this section has to be done outside official hours and it has not been possible to undertake any special botanical collecting trips or do any except economic botanical work in official time.

35. I take this opportunity of thanking the Director of the Royal Botanic Gardens, Kew, and his Herbarium staff for identifying a large number of specimens which were sent to him for naming. I also wish to record my appreciation of the help given by Mrs. J. D. Tothill and Mr. C. G. Hansford in compiling a card index of the Uganda flora, which comprises records of the specimens represented in the herbarium and also those of others collected in Uganda which are as yet absent from our collection.

GENERAL.

36. It was not possible to carry out any special work on tea during the year, but seeds and plants were issued to those who required them. Work on maize was also confined to the increase of stocks and field trials of the varieties previously introduced. Several reports on economic subjects were written in the latter half of the year, including the Indigenous Oil-producing Trees; The Preservation of the Uganda Flora, together with a list of the more important indigenous economic plants and their uses; and the Culture of the Anaphe Silkworm on the indigenous tree *Bridelia micrantha* (Baill.).

J. D. SNOWDEN,

Economic Botanist.

Appendix 1.

HEVEA RUBBER TAPPING (YIELD IN OZS. DRY RUBBER).

1930.

Tree No.	January.	February.	March.	April.	May.	June.	July.	Total 1930.	Total 1927.	Total 1928.	Total 1929.	Grand Total.
22/27	6'00	9'00	5'50	7'50	7'25	5'00	9'50	49'75	100'25	190'50	324'75	665'25
19/90	11'00	8'50	7'50	7'50	8'00	6'25	7'50	56'25	164'00	168'00	130'75	519'00
19/96	34'00	24'00	34'00	22'50	24'00	20'00	31'00	189'50	296'25	307'00	314'25	1,107'00
19/34	8'00	8'50	11'50	10'00	13'50	11'00	14'00	76'50	158'25	202'25	200'00	637'00
19/63	15'00	6'00	10'00	13'00	15'00	13'50	15'50	88'00	166'00	130'00	171'50	555'50
19/65	8'00	7'00	7'00	7'00	7'00	5'50	12'50	54'00	114'75	118'50	95'50	382'75
20/49	25'00	23'00	25'50	15'50	16'50	17'50	25'50	148'50	275'50	223'00	245'00	892'00
20/76	9'00	10'00	11'00	10'50	13'00	7'50	7'00	68'00	172'25	182'75	187'00	610'00
100	19'00	14'00	13'00	10'50	9'50	6'50	6'00	78'50	<i>a</i> 227'75	268'00	239'75	814'00
101	7'00	7'00	7'00	7'00	10'75	3'50	5'00	47'25	<i>a</i> 130'50	117'50	91'25	386'50
102	12'00	7'50	11'50	8'50	8'00	7'50	8'00	63'00	<i>b</i> 118'50	132'25	96'00	409'75
103	14'50	8'50	10'00	11'00	10'00	12'50	3'00	69'50	<i>b</i> 184'25	193'75	132'00	579'50
104	—	8'50	14'00	8'50	14'50	17'50	18'00	81'00	<i>b</i> 104'75	138'50	190'75	515'00
105	12'25	9'00	11'50	7'50	10'00	9'00	9'00	68'25	<i>b</i> 115'50	140'50	146'25	470'50
106	16'00	13'00	11'50	10'00	9'25	10'50	8'00	78'25	<i>b</i> 163'00	163'25	120'50	525'00
107	17'00	12'00	12'50	11'50	11'00	9'00	9'50	82'50	<i>b</i> 103'00	168'50	169'25	523'25
110	13'00	11'00	10'50	9'50	6'25	11'00	12'50	73'75	—	180'25	207'50	461'50
112	12'00	11'00	7'50	7'50	10'50	6'50	9'50	64'50	—	178'00	123'50	366'00
113	7'00	6'00	7'00	6'50	10'50	4'00	4'00	45'00	—	166'25	183'75	395'00

a—Yield for last 11 months.

b— " " " 10 "

ANNUAL REPORT OF THE GOVERNMENT PLANTATION, KAMPALA.

WEATHER.

The total rainfall recorded during the year was 46·06 ins., which is 3·35 ins. less than the average for the last 20 years and 3·90 ins. less than the average for the last six years. The highest rainfall for any one month was 8·17 ins. which fell in May, and the greatest amount recorded during any individual day was 2·94 ins. on May 18th.

The rainfall in January was 2·15 ins., which is unusually high for that month, the average for the four previous years being only 1·10 ins.

CROPS.

COFFEE.

PLOT No. 1 (BOTANICAL PLOT).—The following hybrids and grafts were planted out in September:—

Hybrids.—No. H A x E, eleven trees; No. 1, A x E, eleven trees; No. 2, A x E, twelve trees; No. 3, A x E, twelve trees; H4, ten trees; H3, ten trees; No. 44, two trees; No. 45, two trees; No. 49, ten trees; No. 64, three trees; No. 65, one tree; No. 36, four trees; No. 23, four trees; No. 22, one tree; No. 20, four trees; and Nos. 12 and 13, eight trees.

Grafts.—Three trees of *Arabica* on *Liberica*, two trees of *Robusta* on *Liberica*, and one tree of *Robusta* on *Excelsa*.

Additional supplies of most of the hybrids are available in the nursery beds, should any of those planted out die subsequently.

Owing to the excessive wash on this plot after heavy rains, rows of *Leucaena glauca* seed were sown every five feet across the contour. Germination and subsequent growth has been good.

COFFEE PRUNING EXPERIMENT (PLOT No. 3).—This experiment was laid down in January, 1927, the object of which is to test the effects of the three general pruning systems by comparing the yields of cherry picked from similar sub-plots under each pruning system.

The plot is approximately one acre in area and is divided up into twenty sub-plots. There are seven sub-plots labelled "A" signifying the "Single Stem" method of pruning; seven under the "Agobiada System" (B), and six sub-plots under the "Multiple stem system" (C).

Each sub-plot contains *Arabica* trees spaced 10 feet by 10 feet, originally planted in August, 1924. Shade is afforded to the whole plot by rain trees (*Pithecolobium saman*) spaced at about 40 feet.

All the sub-plots have been pruned according to their respective methods in January of each year. The fruits are picked as they become ripe and are weighed immediately afterwards. In this way there are usually several pickings each month of the year, the first of which was recorded on May 19th, 1927.

The yields in ounces of cherry picked from each sub-plot are recorded in Table A. As would be expected, a steady increase has been obtained from each plot since the commencement of the experiment, though there appears to be no particular reason for the very high yield obtained from plot C (6) during 1930. The figure recorded from this plot represents the highest yield yet obtained, and is nearly seven times as great as the yield from the same plot during 1929.

PLOT No. 4: ROBUSTA SELECTIONS.—The *Robusta* trees in this plot, many of which were in ill-health or otherwise unsuitable, were dug out in March. Two trees only were left, as these were considered by the Botanist to be of a desirable type for seed.

The rain trees were also cut down.

In May the plot was planted up with nineteen Robusta selections received from the Botanist.

The plot was undersown with *Vigna sinensis* which was later dug in as a green manure.

In September a further six selections were planted.

At the close of the year nearly all the trees were alive and growing well. A few have died, but it is expected to be able to fill up these blanks from supplies in the nursery.

OTHER COFFEE PLOTS.—No special work has been carried out on the other Robusta plots on the plantation.

No. 9 selection growing in plot No. 7B, which was originally planted in 1918, has been used as the main supply of seed for distribution and for planting in the nursery. This plot, together with No. 7A, was mulched with elephant grass (*Pennisetum purpureum*) in August. A few undesirable robusta trees growing in plot 7A were dug out on advice from the Botanist.

Eleven inferior trees at the far end of plot 6 were stumped back by the Botanist, with a view to future grafting.

RUBBER.

TAPPING EXPERIMENT.—The object of this experiment was to ascertain which rubber trees, out of a selected number, would produce the biggest yields.

Nineteen trees in all were selected and tapped at regular intervals and the yields in ounces of dry rubber were recorded from each tree.

The method of tapping adopted was on half surface, alternate days, with exception of tree No. 27, which was cut daily for seven-and-a-half months and then changed to alternate days.

Details of yields obtained will be found in the Report of the Economic Botanist.

YOUNG RUBBER (PLOT No. 18).—This plot was planted up with young Para trees in November, 1928, for the purpose of budding. No work of this nature was attempted, however, until September, 1930, when the Botanist budded several of the trees.

TAPPING.—All tapping operations on the plantation ceased at the end of July.

TEA.

PLOT No. 32.—Picking of leaf from this plot has been maintained throughout the year, there being a fair demand for the prepared tea.

The old tea plot near the plantation house is practically the sole source of tea seed. Over 270,000 seeds were supplied to estates during the year.

PLOT No. 25.—This plot is divided up into thirty-two sub-plots, each containing thirty-six trees. The soil for the most part is poor, and a number of the tea trees had previously died. The varieties planted are Kaline, Manipuri, Thanai, Assam Indigenous, and all trees have been allowed to go to seed.

Owing to the large percentage of blanks in most of the sub-plots, seed has been collected and sown in the nursery beds for planting out next year. The same procedure has been carried out with the Kaline variety at the corner of Plot No. 21B, and the Thanai Assam in Plot No. 19.

HYDNOCARPUS.

There are two strips of *Hydnocarpus Wightiana* growing on the top half of plot No. 19. Several of these have produced flowers and fruits during the year for the first time since they were planted out in April, 1927.

Out of a total of 204 trees, approximately 40% are known to be male trees, 18% are known to be female trees, while the remainder are as yet undetermined due to the fact that they have not yet produced flowers. Plans have been drawn and each tree numbered, and it is proposed to keep individual yield records as soon as the fruits are ready to pick.

The whole plot was undersown with *Centrosema pubescens* in September.

Plot No. 11A contains a few trees of *Hydnocarpus anthelmintica* which were planted out in 1929. So far none of the trees have produced flowers.

A few young plants of both varieties were planted out to fill up the blanks in the two plots.

MISCELLANEOUS FRUIT PLOT (No. 13).

This plot contains young fruit trees of the following varieties:—Persimmon "Mazelli" (2), Persimmon "Gambouchi" (originally two trees, but one since died), Persimmon "Tipo" (3), Avocado pear (1), *Anona squamosa* (3), *Anona Cherimolia* (3), *Anona muricata* (2), *Dillenia indica* (2).

The single specimens of *Durio zibethinus* and *Nephelium Litchi*, and both trees of *Nephelium lappaceum* (Rambutan) have died.

INTRODUCED CITRUS PLOT (No. 15).

A number of imported Citrus trees were planted out in May, 1929, and the plot was undersown with *Centrosema pubescens* later in the year. The following are the names of the trees planted:—

- | | |
|--------------------------------------|--------------------------------------|
| 1. Tahitian Lime (Seedless). | 8. Orange, "Valencia Late." |
| 2. Tangerine "Emperor." | 9. Orange, "Du Roi." |
| 3. West Indian Lime. | 10. Orange, "Golden Buckeye." |
| 4. Tangerine. | 11. Grape fruit, "Marshes Seedless." |
| 5. Orange, "Beauty of Glen Retreat." | 12. Grape fruit, "Marshes Seedless." |
| 6. Orange, "Pineapple." | 13. Grape fruit, "Royal." |
| 7. Orange, "Washington Navel." | 14. Tangerine. |

Two trees of each of the above were planted, but one of the trees of No. 14 has since died.

Nos. 1—11 were received from South Africa and the remainder from Jamaica. By the end of the year all trees with the exception of Nos. 4, 12, 13 and 14 were producing their first fruits.

ESSENTIAL OIL PLANTS.

The introduction of plants suitable for extracting essential oils was commenced by the Botanist during the year, and the following have been planted out in small quantities on the plantation:—*Coleus* spp., *Ocimum* spp., *Leonotis*, Patchouli, Lavender, *Pelargonium*, Tuberose, Scented Verbena, Mimosa, and Vetiver grass.

In addition, plot No. 14 has been put down to Frangipani, spaced 4 by 8 feet. The plot was undersown with *Crotalaria alata*, and both Frangipani and cover crop have grown well.

MISCELLANEOUS.

TUNG OIL.—Ten *Aleurites* trees (Tung oil) were planted out in plot No. 17, in a single row parallel to the orange hedge. Of these ten trees, one is *A. montana*, and the remainder are *A. Fordii*. Of the latter, one has since died though the rest have grown well. The single specimen of *A. montana* is rather backward.

COTTON.—Plot No. 21A and plot No. 12 were again reserved for the Entomologist and Mycologist respectively as areas for cotton in connection with their laboratory work. As soon as the cotton was uprooted, both plots were green manured and again put down to cotton in July—August.

SUGAR CANE.—The following varieties have been grown on the plantation:—B.A. 11403, B.A. 2001, B.A. 8409, R.P. 6, S.C. (12) 4, B.H. (10) 12, P.O.J. 2714, P.O.J. 2725, P.O.J. 2727, P.O.J. 213, P.O.J. 2379, P.O.J. 2878, and "White Transparent." The selection and arrangement of these varieties has been carried out by the Mycologist, who supplied several estates with planting material throughout the year.

VANILLA.—The small area of vanilla situated close to plot No. 32 has been renovated and fresh poles put in.

VETIVER GRASS AND BOEHMERIA NIVEA.—Adjoining the vanilla plot, a previously uncultivated area has been prepared and planted up with Vetiver grass and *Boehmeria nivea*. This was done at the request of the Botanist who needed extra space for the extension of these crops. Immediately above this area, six of the Botanist's coffee grafts have been planted out.

PICALIMA.—Some of the Picalima trees in plot No. 1 have produced fruits. The seeds from these were collected and a certain number were sent to England in order to test the value, if any, of the alkaloids contained therein.

NURSERY.

The usual routine work in connection with the raising of coffee plants and fruit trees was continued during the year. Nearly all the shades over the beds have been repaired and new uprights put in. This was effected by cutting down the *Eucalyptus* trees growing in the swamp. The stumps have been allowed to coppice and fresh seedlings will be planted to fill in any blanks.

DISTRIBUTION OF PLANTS AND SEEDS.

				COFFEA ROBUSTA.			C. ARABICA.	TEA SEED.	
				Plants.	Seedlings.	Seed.	Seed.	Seed Number.	Plants.
To	Natives	...	...	23,577	—	—	—	4,600	12
„	Nurseries	...	...	—	74,682	37 lbs.	—	—	—
„	School Gardens	...	...	10	—	—	10 lbs.	—	—
„	Other	...	...	28,100	—	134 lbs.	4 „	270,280	924

				FRUIT TREES.	SUGAR CANE.	VARIOUS.		
				Plants.	Tons.	Plants.	Cuttings.	Seeds.
To	Natives	...	...	40	—	—	—	—
„	School Gardens	...	...	—	—	—	—	10 lbs.
„	Others	...	...	996	5	112	1,686	12 „

R. W. STUCKEY,
Agricultural Officer.

TABLE A.

DATA OF COFFEE CHERRY PICKED FROM PRUNING EXPERIMENT.

PLOT No. 3.

System.		1927.	1928.	1929.	1930.	Total for the last 4 years.
A :—		<i>Ozs.</i>	<i>Ozs.</i>	<i>Ozs.</i>	<i>Ozs.</i>	<i>Ozs.</i>
1	...	317.50	179.50	550.50	747.50	1,795.00
2	...	328.75	332.50	355.00	1,676.50	2,692.75
3	...	220.75	243.50	381.75	1,131.50	1,977.50
4	...	235.00	514.50	254.50	1,301.50	2,305.50
5	...	216.50	289.00	765.75	1,440.00	2,711.25
6	...	249.00	169.00	1,055.50	935.00	2,408.50
7	...	249.75	377.00	288.50	687.00	1,602.25
TOTAL	...	1,817.25	2,105.00	3,651.50	7,919.00	15,492.75
B :—						
1	...	235.50	110.50	440.00	1,202.50	1,988.50
2	...	494.00	284.00	982.00	1,587.50	3,347.50
3	...	403.75	290.00	1,165.00	1,243.50	3,102.25
4	...	323.50	229.00	1,296.00	1,442.50	3,291.00
5	...	129.00	147.00	831.00	1,148.00	2,255.00
6	...	198.25	138.00	829.50	2,080.00	3,245.75
7	...	179.75	137.00	592.50	1,259.50	2,168.75
TOTAL	...	1,963.75	1,335.50	6,136.00	9,963.50	19,398.75
C :—						
1	...	115.25	102.50	249.25	952.50	1,419.50
2	...	89.25	201.00	375.50	1,333.50	1,999.25
3	...	135.25	280.00	774.25	1,574.50	2,764.00
4	...	48.00	188.50	470.50	1,667.50	2,374.50
5	...	71.00	224.50	763.50	1,421.75	2,480.75
6	...	113.75	222.00	407.50	2,756.50	3,499.75
TOTAL	...	572.50	1,218.50	3,040.50	9,706.25	14,537.75

A—Signifies Single Stem.
B—Signifies Agobiada.
C—Signifies Multiple Stem.

ANNUAL REPORT OF THE BOTANIC GARDENS, ENTEBBE.

WEATHER.

The rainfall during the period has been erratic as some months had rain above and some below the average and the rainfall for the twelve months—53·65 inches—is less than the average for the whole year by 5·61 inches.

The months January to March, May, June and September had rains above the average, whilst April, July, August, October, November and December were below.

The temperature moved with the rainfall, when it was excessive being below the average, and when the rain was deficient going above the average.

OIL PALMS.

Records of all individual oil palms have been kept and tabulated each month.

The following table gives an indication of the yield of some of the palms under observation, and the variation between individual trees :—

No. of Palm.	No. of Seed.		Weight of seed in pounds and ounces.			
	1929	1930	1929		1930	
			<i>lbs.</i>	<i>ozs.</i>	<i>lbs.</i>	<i>ozs.</i>
12 	710	1,141	46	10	77	12
45 	20	7	1	10	0	10
53 	678	1,428	24	8	62	13
93 	919	1,007	55	10	58	12
109 	434	73	13	7	2	4
158 	108	232	7	9	8	9
198 	949	502	44	15	21	3
205 	337	1,592	14	12	53	3

The total number of palms was 243, out of which 105 were removed at the end of July and 138 left. The planting distance between each palm was 10 ft. by 20 ft. which after thinning out has now become as far as possible 30 ft. by 20 ft. It was an arduous task to remove the stumps of cut palms and most of the labouring staff were engaged on this work until it was completed.

The palms have also been cleared during the year of all dead and diseased leaves and fruits.

The leaves below the young bunches have been periodically removed to permit of the bunches' unhampered growth, and this has been beneficial in its effect as since this practice was adopted the bunches have enlarged and the seeds have been better developed in size. Previously many of the bunches did not mature as the fruits did not develop properly owing to their growth being constricted between the leaves and fibrous growth around the stems.

The table below shows the number of trees yielding, etc., till the end of December :—

		<i>Produced Seed.</i>	<i>New Yielders.</i>	<i>Ceased Yielding.</i>
Total palms	...	117	65	22
Palms cut	..	29	14	8
Palms remaining	...	88	51	14

RUBBER.

Tapping on individual trees in blocks Nos. 1, 2 and 3 was carried on from the beginning of the year.

Tapping on individual trees in blocks Nos. 4 and 6 was continued till the end of July, when it was stopped and the trees rested. Four trees from block No. 4, *viz.* Nos. 9, 20, 24 and 25, and all the five trees in block No. 6, *viz.*, Nos. 1, 3, 4, 5 and 6, were, pollarded for the production of bud-wood for vegetative propagation as they had proved to be high yielding trees.

Two shoots for budding purposes, one from tree No. 9 in block No. 4 and one from tree No. 5 in block 6, were obtained and taken to Kampala for budding experiments.

Most of the pollarded trees have sent out shoots but they are still too young for use as bud-wood.

The trees are tapped on a one-third surface left to right cut. Blocks Nos. 1, 4 and 6 are tapped on Mondays, Wednesdays and Fridays, and blocks Nos. 2 and 3 on Tuesdays, Thursdays and Saturdays.

The records for each tree have been tabulated. The following table shows yields obtained from some of the trees under observation :—

Tree No.	1925			1926			1927			1928			1929			1930		
	...	lbs.	ozs.	...	lbs.	ozs.	...	lbs.	ozs.	...	lbs.	ozs.	...	lbs.	ozs.	...	lbs.	ozs.
9.4	...	1	0½	...	7	8	...	9	10	...	7	1	...	6	15	...	5	14
5.6	...	1	4	...	9	12	...	9	14	...	8	12	...	10	13	...	8	7
20.4	...	1	1	...	4	5½	...	9	2	...	6	11	...	6	15	...	5	15
24.4	...	0	13½	...	7	0½	...	9	3	...	6	11	...	7	2	...	8	9
25.4	...	1	4	...	7	13	...	8	12	...	6	0	...	8	15	...	6	12
1.6	...	1	2	...	9	15	...	10	11	...	8	13	...	7	0	...	4	12
6.6	...	1	5	...	9	8	...	10	3	...	9	1	...	10	9	...	8	8
1.4	...	1	3	...	6	13	...	9	2	...	8	4	...	5	15	...	5	0
29.4	...	0	15	...	3	12	...	2	12	...	2	13	...	6	14	...	5	7

CACAO.

The year has not been favourable to cacao owing to the vagaries of the rainfall and the pod production has fallen below last year's yields.

The two monkeys which still remain do not seem to have done much damage.

The tables on page 83 give a summary of the yields obtained during 1930.

COFFEE.

A total of 20,010 coffee seedlings were distributed from the Gardens to the nurseries in districts as under :—

Kabulasoke Coffee Nursery	...	...	...	7,760
Kalyaboga	..	..	...	6,250
Buwama	..	..	...	2,500
Kituntu	..	..	...	2,000
Nkozi	..	..	...	1,500
TOTAL				20,010

These seedlings were raised from several pounds of selected coffee robusta seeds supplied by the Botanist.

HYDNOCARPUS.

Hydnocarpus Wightiana and *H. anthelmintica* planted in the plot near the store have become well established. The former are more dwarf and bushy while the latter are inclined to be taller and less dense.

FRUIT TREES.

The fruit trees planted near the *Hydnocarpus* are doing well and two *Nephelium malaiense* and one *Anona cherimolia* have been planted in the plot this year. *Centrosema Plumieri* has been planted as a cover crop between the trees.

CACAO.

VALUE OF TREES IN EACH PLOT IN POD PRODUCTION AND TOTAL YIELDS, 1930.

No. of Plot.	Variety.	No. of trees which gave a yield of pods.					Total No. of trees.	Total yield of pods.	Average No. of pods per tree.	Total yield of dry cacao beans.	Average No. pods to 1 lb. of dry cacao.	Average yield of dry cacao beans per tree.	Distance of planting.	Average total yield per acre of dry cacao beans.
		Nil.	Under 5.	5 to 10.	11 to 20.	21 to 35.	36 to 50.	Over 50.						
1	Calabacillo Forastero	...	3	5	4	4	2	6	28	678	24	40 lbs., 6 ozs.	18 by 18	193 lbs., 4 ozs.
		...	3	5	4	—	2	1	17	287	17	10 6	18 by 18	81 12
2	Calabacillo Forastero	...	5	1	3	2	—	3	15	347	23	13 12	18 by 18	122 13
		...	2	3	2	3	—	—	11	93	8	5 12	18 by 18	64 11
3	Calabacillo Forastero	...	12	8	9	5	2	—	38	268	7	16 6	15 by 15	84 7
		...	10	4	6	5	4	—	36	471	13	22 10½	15 by 15	122 10

The following table gives individual tree yields for 1930 obtained from selected trees:—

CACAO.

INDIVIDUAL RECORDS, 1930.—SELECTED TREES.

Plot No.	No. of tree.	Total No. of pods.	Weight of pods.	Average weight of pods.	Total yield of dry cacao beans.	Average No. of pods to 1 lb. of dry cacao.	% of dry cacao to total weight of pods.	Total pod production since 1917.	Average yield of pods per year.
1	7	8	7 6	0 14	0 10	20	8½	1,305	93
	9	—	—	—	—	—	—	848	61
	22	78	47 7	0 10	4 11	15	9·9	1,926	138
	82	30	35 0	1 3	1 12	15	5·0	1,342	96
2	50	—	—	—	—	—	—	924	66
	55	—	—	—	—	—	—	462	33
	67	139	89 1	0 10	3 15½	7	4·4	1,324	95
								Since 1922:—	
3	2	11	8 1	0 12	0 11	16	8·5	396	44
	4	45	20 3	0 7	1 7½	8	7·1	1,071	121
	34	10	29 11	2 15	0 8	13	1·7	593	66
	41	—	—	—	—	—	—	543	60

DISTRIBUTION OF PLANTS AND SEEDS.

The following were distributed during the year :—

	<i>Plants.</i>		<i>Seed.</i>	<i>Bundles.</i>	
Economic :—					
Coffee robusta	...	20,010	...	—	Lawn grass ... 7
Various	...	2,535	...	{ 134 pkts.	Verbena ... 4
				{ 81 single.	—
Decorative	...	6,597	...	{ 263 pkts.	11
				{ 120 single.	—

The following fruit trees were distributed during the free distribution in April :—

	<i>Plants.</i>			<i>Plants.</i>	
Blackberries	...	48	Mango	...	143
Breadnut	...	5	Mulberry	...	73
Carambola	...	25	Orange	...	335
Granadilla	...	1	Orange, Mandarin	...	206
Grapefruit	...	180	Orange, Tangerine	...	6
Guava, Apple	...	114	Pitanga cherry	...	91
Guava, Common	...	49	Pomegranate	...	1
Strawberry Guava	...	68	Raspberry	...	64
Jack fruit	...	55	Rose apple	...	185
Lemon, rough	...	32	Soursop	...	3
Lemon, smooth	...	52	Strawberry	...	121
Lime	...	150	Papaw	...	3
Loquat	...	144	Golden apple	...	6
Ceylon gooseberry	...	2			

Seeds :—

Avocado pear	...	...	9	single seeds.
Carambola	...	...	1	packet.
Ceylon gooseberry	...	...	3	packets.
Cherry guava	...	...	4	„
Other guavas	...	...	4	„
Granadilla	...	...	1	packet.
Governor plum	...	...	1	„
Papaw	...	...	3	packets.
Passion fruit	...	...	1	packet.
Tree tomato	...	...	2	packets.

INTRODUCTION OF PLANTS AND SEEDS.

A total of 16 packets, 20 seeds and some bulbs were received during the year and thanks are accorded to the following for their contributions :—

Director, Jardin Botanique d'Eala, Congo Belge.
 Director of Gardens, Singapore, Straits Settlement.
 Director, Plant Industry, Manila.

LAWNS AND FLOWER BEDS.

No difficulty has been experienced in keeping the lawns neat and well cut, though the motor mowers have not been used from the middle of the year. These had to be stopped owing to constant breakdowns and repairs and the abnormal consumption of petrol.

At present only three long grass and two ordinary mowers are being worked, and certain lawns have been allotted to each machine which must be finished every week, and this ensures that the grass does not get time to grow up and was conducive to the good appearance of the lawns throughout the year.

The rose garden has not been the success it was expected to be, though in certain parts the roses have established and make some show of flower.

The climbers trained on the pergola are doing fairly well.

In certain parts roses have not been able to become established as the ground is too stony.

All the beds and borders have been manured with leaf mould twice and some three times and this has given a great impetus to the plants, which have since made good growth.

Seven large pits have been made and all available leaves are being put there to rot, and when ready plenty of leaf mould will be available for the gardens.

Many plants were suffering from the poor soil and lack of manure, which is now being remedied as far as possible.

Fungous growth and dead twigs were removed from all the smaller trees and plants, which has improved their appearance a good deal.

Roses were pruned heavily where they had become big bushes and yielding few flowers.

The Canna beds near the rose-apple and mango trees were uprooted and after manuring replanted and the Rudbeckia bed also received similar attention. A new bed was made in the lawn above the rose garden and *Mimosa pudica* planted there with *Schinus molle* in the centre.

Different seeds of annuals were sown in the Lake borders which at present are making a good show of flowers.

Zinnias have been planted in a bed near the rose apple trees and *Gaillardia pulchella* in another bed which previously contained roses, but these had been eaten by white ants.

The lawn near the Para block No. 6 was levelled to permit of being mown by lawn mowers.

The following plants were planted in lawns in various parts of the Gardens:—

1 <i>Macadamia ternifolia</i> .	2 <i>Cyrtostachys Lakka</i> .
3 <i>Schinus molle</i> .	1 <i>Caryota mitis</i> .
1 <i>Cassia grandis</i> .	4 <i>Acacia</i> sp.
1 <i>Cassia Manuii</i> .	8 <i>Phoenix</i> sp.
1 <i>Poinciana regia</i> .	

GENERAL.

All roads and drains have been kept in good condition throughout.

A stone drain was constructed alongside the road leading to the nursery.

The road near the Cassia plot which was in a bad condition and full of ruts has been gravelled and rolled and a deep drain made alongside it to carry the rain water and prevent wash. Since this was done, the road has required very little attention and is in an excellent condition. The corner also, which was very narrow and dangerous, has been widened and all the shrubs obstructing the view cut.

All overhanging branches of trees have been pruned back.

Almost all the trees in the gardens now have labels affixed to them or, in the case of plants, stuck in the ground fixed to a stout stem of corrugated iron 15 inches long.

A drain was made in the Podocarpus avenue to allow water to pass freely.

The new office, which is near the Gardens, was completed at the end of August and it was occupied on the 1st September.

J. D. SNOWDEN,

Economic Botanist.

List of Circulars obtainable from the Director of Agriculture, Entebbe:—

No.

2. COTTON CULTIVATION.
3. DISEASES OF *HEVEA BRASILIENSIS* IN UGANDA.
4. DIEBACK OF *COFFEA ARABICA* IN UGANDA.
7. REPORT ON COFFEE CULTIVATION IN UGANDA.
8. DISEASES OF CEREALS IN UGANDA.
9. DISEASES OF *COFFEA ARABICA* IN UGANDA.
13. COFFEE BUG (*ANTESTIA LINEATICOLLIS* STAL., VAR).
14. *COFFEA ROBUSTA* IN UGANDA.
15. CULTIVATION AND PREPARATION OF *COFFEA ROBUSTA*.
16. COTTON EXPERIMENTS 1925—1926.
17. (A) THE OCCURRENCE OF ANGULAR LEAF-SPOT OF COTTON IN UGANDA.
(B) ROT OF *HEVEA CORTEX* IN UGANDA.
18. RUBBER EXPERIMENTS ON THE GOVERNMENT PLANTATION, KAMPALA.
19. SUGAR CANE IN UGANDA.
20. NOTES ON THE CULTIVATION, CURING AND PACKING OF FIRE-CURED TOBACCO.
21. SOIL MANAGEMENT AND MANURING.
22. VARIEGATED COFFEE BUG (*ANTESTIA* SPP.).